



Using Health IT in Practice Redesign: Impact of Health IT on Workflow



Patient-Reported Health IT and Workflow



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Preface

This project was one of three task order contracts awarded under the request for task order (RFTO) titled “Using Health IT in Practice Redesign: Impact of Health IT on Workflow.” The RFTO funded methodologically rigorous research studies of the implementation of health IT in support of practice redesign in ambulatory care settings. These studies were designed to provide an enhanced understanding of the causal relationships between health IT and workflow processes.

About ACTION II

This project was funded as an Accelerating Change and Transformation in Organizations and Networks (ACTION) II task order contract. ACTION II is a model of field-based research designed to promote innovation in health care delivery by accelerating the diffusion of research into practice. The ACTION II network includes 17 large partnerships and more than 350 collaborating organizations that provide health care to an estimated 50 percent of the U.S. population.

For more information about this initiative, go to
<http://www.ahrq.gov/research/findings/factsheets/translating/action2/index.html>

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Executive Summary

Introduction

Effective implementation of health information technology (IT) can support improvements to the quality and efficiency of ambulatory care. Health IT implementation may also have a profound impact on workflow. Few published articles have examined the impact of health IT implementation in primary care, and even fewer have examined the impact on workflow. Most of the literature is descriptive, and sociotechnical factors are often ignored. In this study we focus on a specific form of health IT—applications allowing patients to share information with clinics electronically—and examine their impact on workflow. We also explore how clinics redesign their information workflows to incorporate information shared electronically by patients.

Background

Several reviews have summarized and assessed studies on patients providing information electronically. Most studies have focused on the impact of patients providing information electronically on patient outcomes. A 2012 review of the literature by Goldzweig et al.¹ showed that some evidence suggests that patients' access to their records and secure messaging can improve health outcomes (e.g., blood sugar control in patients with diabetes), adherence (e.g., rate of colorectal cancer screening), and patient satisfaction. A 2014 systematic interpretative literature review by de Lusignan et al.,² who based their analysis on the 2012 review by Goldzweig et al., came to the following conclusions with regard to patients' online access to their medical records: (1) patients' adoption of such online access to their medical records has been slow; (2) there is no evidence of improved health outcomes resulting from patients having this access; but (3) this online access may improve patient safety. Improvements are made mainly through the identification of medication errors and adverse drug reactions (e.g., Schnipper et al.³ and Ralston et al.⁴), improved patient satisfaction through better self-care (e.g., Fisher et al.⁵ and Saparova⁶), and improved patient-provider communication.^{7,8}

Ammenwerth et al.⁹ recently published a systematic review on the impact of patient portals on patient care, including only studies with a controlled experimental or quasi-experimental design. The results of this review confirm other reviews' findings.^{1,2} No evidence was found of improvement in health outcomes such as mortality or hospitalizations, but intervention groups who had access to a patient portal scored better than the control group on medication adherence¹⁰ and adherence to medical advice.¹¹

Relatively few studies have examined the impact of patient-provided information on clinic workflow. In 2005, Liederman and colleagues¹² examined the impact of secure messaging on patient, provider, and staff satisfaction, and on provider message volume in primary care clinics. Results showed that uptake of the secure messaging was slow; one year after implementation, 6,394 patients were enrolled in secure messaging, out of a panel of 135,000 patients (4.7 percent). These patients sent 6,731 messages in 6 months: fewer than 21 percent sent four or more messages; 34 percent sent two to three messages; and nearly half (45 percent) sent a single message.

Several studies have examined reasons why uptake of patient portals and secure messaging is so low among patients. For example, a 2011 study by Goel et al.¹³ identified patient-reported barriers to patient portal enrollment in one primary care clinic, showing that 26 percent of patients did not remember having discussed a patient portal with their providers, 6 percent did

not attempt enrollment despite remembering the discussion, and 11 percent attempted to enroll but did not succeed in doing so.

Several studies have examined the impact of patient portals on provider *workload*. According to the systematic literature review by de Lusignan et al.,² the impact of patient portals is not consistent: seven studies reported an increase in workload (e.g., Palen et al.¹⁴); two studies reported a temporary increase in workload that afterwards plateaued (e.g., Liederman et al.¹²); and eight studies reported a reduction in workload (e.g., Ye et al.⁷). However, in most of these studies workload was measured at the *clinic level* (e.g., volume of secure messages compared with telephone call volume), and not at the individual level. In other words, it is difficult to determine whether providers or staff experienced a change in their workload.

Some studies examined the volume of secure messages per provider. For example, a study on patient portal use in Finland showed that, on average, patients used the electronic messaging system only 6 times a year.¹⁵ A study by Lin et al.¹⁶ showed that primary care providers in an academic internal medicine clinic received on average one message per day from 250 patients with access to secure messaging. Several studies indicate that volume of secure messages is low (approximately two secure messages per day per provider), and that providers spend about 5–10 minutes a day responding to them.^{12,17,18}

Several studies examined the effect of the information that patients provide electronically on communication, including the impact on the volume of patient-provider communication and the quality of the communication. In a systematic review, Ye et al.⁷ examined the role of secure messaging in patient-provider communication. Results showed that both patients and providers recognized the benefits of secure messaging. Several studies concluded that secure messaging has great potential to improve patient-provider communication (e.g., Katzen et al.,¹⁹ Leong et al.,²⁰ and Virji et al.²¹).

Some of the studies in the review analyzed the content of secure messages exchanged between patient and provider. Most of the secure messages were about nonacute issues, but results of a study by Rosen and Kwok²² showed that nearly 6 percent of secure messages were urgent, and 0.002 percent required the provider's immediate attention. Several studies examined the characteristics of secure messages and noted that messages were mostly brief, formal, and medically relevant.²³⁻²⁵ The study by Roter et al.²³ compared the content of the messages sent by patients with those sent by providers to their patients. Results showed that provider messages in general were shorter and more direct than patient messages. In general, studies find that patients are satisfied with secure messaging.^{19,20}

In summary, several studies examined patients providing information electronically to their primary care clinic. Most studies have examined the use of patient portals or secure messaging, and focused on patient outcomes; few studies examined the effect on workflow of information provided by patients electronically, or how clinic workflows are redesigned to incorporate information that patients provide electronically.

Importantly, none of these studies have taken the sociotechnical context into account, and none have examined the impact on clinic staff workflow. In this research we examine the impact of various health IT applications patients have used to report information to the clinic electronically, specifically assessing their effects on the workflow of clinicians, staff, and patients, and on the clinic. We also examine the impact of the sociotechnical context on the workflow related to patient-provided information.

Study Goals

We examine the impact of the use of health IT to capture and use patient-reported information on workflow in primary care clinics, focusing on three specific health IT applications: secure messaging between patients and the clinic; electronic forms that patients can complete on a computer, either at home or in the clinic; and a patient portal application that allows patients to upload clinical data such as blood pressure and blood sugar values and share the information with their providers.

We assess the impact of these health IT applications on workflow in the clinic, and examine the impact of the clinic sociotechnical context on the use of these applications. The study addresses three research questions:

1. How does the use of health IT to capture and use patient-reported information support or hinder the workflow from the viewpoints of clinicians, clinic staff, and patients?
2. How does the sociotechnical context influence workflow related to the capture and use of patient-reported information?
3. How do clinics (clinic staff and providers) redesign their workflows to incorporate the capture and use of patient-reported information?

Methods

This study uses a multiple case study design with mixed methods for data collection.^{26, 27} The six participating clinics (i.e., six cases) were primary care clinics located in medium-sized cities, two located in the Southeastern United States and four in the Midwestern United States.

Setting

The study sites were identified through a practice-based research network for a southeastern state, and through professional networks of the researchers. Clinics were targeted for recruitment if they provided primary care, used one or more health IT applications that allowed patients to report information electronically, and were either small (4 or fewer full time physicians) or medium-sized (5–10 full time physicians). Clinics were excluded from consideration if they had not been using at least one health IT application of interest for 12 months prior to data collection. Participating clinics were paid a \$5,000 stipend.

Table A summarizes the clinics in the study and the health IT applications for patients to provide information electronically that are in use in each clinic. Although we collected data on all health IT applications used for capturing and using patient-reported information in the study sites, some applications had been used by a clinic only briefly for a small number of patients, and were no longer in use; these are indicated with (X) in Table 1. In other cases, the clinic had only begun to use the health IT application shortly before data were collected; these are indicated with [X]. For some parts of our analyses, the data for brief use of these applications were too limited to warrant inclusion (e.g., a single clinic interviewee had used the application a few times).

Table A. Health IT applications allowing patients to share information electronically, by clinic

	Clinic 1 medium Midwest	Clinic 2 small Southeast	Clinic 3 small Midwest	Clinic 4 medium Southeast	Clinic 5 medium Midwest	Clinic 6 small Midwest
Secure messaging	X	X	X		X	X
E-forms	X			X		[X]
Patient portal (uploading information)			(X)		X	

(X): clinic no longer uses the application; [X]: clinic has recently begun using the application.

Five clinics in our study use secure messaging to communicate with patients. Two clinics use e-forms, while one began to use an e-form only months before data were collected. One clinic has patients actively uploading information into its patient portal, while another used this application only briefly. One limitation of our research is that our multiple case study design included six cases, which limits the generalizability of our findings, particularly in cases where fewer than six clinics were using a health IT application.

Data Collection Procedure

We collected data using a preliminary conference call guide; pre-visit questionnaire; clinic tour guide; interviews with clinic managers, physician leaders, and patients; interviews and observations with clinicians and staff; a survey; and a postvisit followup call guide. If possible, the clinic manager demonstrated the health IT used in the clinic, particularly the health IT applications related to patients sharing information electronically. A Web-based survey was distributed to 152 clinicians and staff, of whom 118 completed the survey: a response rate of 78 percent.

Data Collection Instruments

Prior to the site visit, we used a preliminary conference call guide to conduct a call with the clinic manager and/or physician leader to explain the research study and discuss logistics for the site visit. We also used a pre-visit questionnaire to collect data on clinic characteristics and the implementation of health IT applications.

On the first day of the site visit, we asked the clinic manager to use the guide we created to provide the data collection team with a tour of the clinic. Afterward, we used a clinic manager interview guide to collect additional information about the overall background of the clinic: the history, type of patients, organization of work, workflow, and health IT. The clinic managers were asked about the impact of health IT applications to capture and use patient-reported information on clinical workflow, and what changes had occurred in the clinic as a result of the health IT implementation.

We used a physician leader interview guide to collect information about the history and current status of health IT in the clinic; the available support related to health IT; plans for health IT implementation; facilitators and barriers to workflow related to health IT; and the impact of health IT on the clinic, including the impact on quality of care and patient safety. The physician leaders were also asked about opportunities for redesign of work and workflow in the clinic.

We used an interview guide and an observation sheet to conduct interviews and observations with clinicians and staff. The interview guide contained questions about the sociotechnical context, use of the health IT applications to capture and use patient-reported information in daily

practice, effects on workflow, facilitators and barriers to use of the health IT application, usefulness and usability of the application, the possible impact of the application on quality of care and patient safety, and the possibility of using the application to redesign their work and workflow.

We used a brief patient interview guide to conduct patient interviews asking about patient experiences with the health IT applications, and the usability and usefulness of these applications.

We used a Web-based questionnaire survey to gather information about user experiences of clinicians and staff with regard to the health IT applications.

After each site visit, we conducted a one-hour conference call with the clinic manager and/or physician leader to review workflow process maps developed from interview and observation data, using the postvisit followup call guide.

Data Analysis

Interview data analysis. Based on the interviews with clinicians, staff, and patients in the first clinic, we developed a node structure to code and analyze facilitators and barriers to workflows related to the three health IT applications. The data were then coded using a qualitative analysis software (Dedoose®). After the data from all clinics were coded, we analyzed the data to identify the most frequently reported facilitators and barriers to workflow for secure messaging, e-forms, and the uploading of information through a patient portal. The data were coded using the dimensions in Table B. We use the term dimension because the same dimension can sometimes be perceived as a barrier and a facilitator to the workflow associated with a health IT application. Further, we distinguished between (1) workflow facilitators and barriers, and (2) facilitators and barriers to possible outcomes (i.e., satisfaction with technology, patient satisfaction, and perceived quality of care and patient safety). Because our analyses focus on workflow barriers and facilitators, we briefly present the findings related to outcomes in a single section.

Table B. Dimensions of facilitators and barriers to the workflow of health IT applications to capture and use patient-reported information

Dimensions	Definition as a barrier	Definition as a facilitator
Amount of work	The health IT application has increased workload, including an increase in amount of work, more time needed to finish tasks, and duplication of tasks.	The health IT application has decreased workload, including a decrease in amount of work, and less time needed to finish tasks.
Task complexity-simplicity	The health IT application has made processes more complex. This includes having more actors involved in a task and having to complete more steps per task.	The health IT application has made processes less complex, including having fewer actors involved in a task and having to complete fewer steps per task.
Inappropriate use	Clinicians, staff, or patients use the health IT application in a way that the clinic did not intend it to be used.	Not applicable.
Workaround	Not applicable.	Clinicians, staff, or patients develop workarounds to circumvent barriers related to use of the health IT application in order to get their work done.
Usability*	Problems related to the design of health IT applications have an impact on effectiveness, efficiency, and satisfaction of users.	Characteristics of the design of health IT applications support effectiveness, efficiency, and satisfaction of users.
Communication and information flow	The health IT application has changed communication or information flow for the worse. Communication has become more difficult, or information flow has changed for the worse. Includes communication with patients, clinicians, or staff; frequency of communication; and quality of communication.	The health IT application has improved communication or information flow, including communication with clinicians, patients, or staff; frequency of communication; and quality of communication.
Ambiguity-clarity	The health IT application has caused processes and tasks to become more ambiguous, including who will perform specific tasks and when. (This excludes issues specifically involving communication.)	The health IT application has caused processes and tasks to become clearer and less ambiguous, including who will perform specific tasks and when. (This excludes issues specifically involving communication.)
Organization of work	The health IT application has had a negative impact on work processes and tasks, including the sequence of tasks, who does tasks and when, priority of tasks, and dependency of tasks on other tasks.	The health IT application has had a positive impact on work processes and tasks, including the sequence of tasks, who does tasks and when, priority of tasks, and dependency of tasks on other tasks.
Satisfaction with technology	The health IT application has had a negative impact on the user's satisfaction with health IT used in the clinic.	The health IT application has had a positive impact on the user's satisfaction with health IT used in the clinic.
Perceived patient satisfaction (clinicians and staff only)	The health IT application has made patients less satisfied with the clinic or the care they receive.	The health IT application has made patients more satisfied with the clinic or the care they receive.
Quality of care and patient safety	The health IT application has negatively affected the quality of care and patient safety.	The health IT application has positively affected the quality of care and patient safety.

* Definitions of usability barrier and facilitator are based on the ISO 9241 definition ("The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use.").

Survey data analysis. Survey data were entered and analyzed using SPSS®. Statistical analyses were performed for descriptive statistics and to compare groups of people (χ^2 and t-tests).

Results

This study addresses three research questions. In this section we present the results of our data analysis, describing the results for each health IT application separately. In the conclusion section we discuss the overall impact of these applications on workflow.

We answer research question 1 for each of the three health IT applications in turn.

Research Question 1: How does the use of health IT to capture and use patient-reported information support or hinder the workflow from the viewpoints of clinicians, clinic staff, and patients?

Facilitators and Barriers To Secure Messaging

Five of the six clinics use secure messaging. Results show that the most frequently reported facilitators for clinicians are communication and information flow, organization of work, and the amount of work. The same dimension (e.g., communication and information flow) can act as both a barrier and a facilitator.

One important facilitator related to communication and information flow is that secure messaging adds another line of communication and thereby provides patients with easier access to the clinic, which in turn improves patient-clinician communication. Other facilitators for clinicians are the organization of work and the amount of work. The organization of work can be improved due to the asynchronous nature of secure messaging, because a clinician can reply to a message when s/he prefers. Using secure messaging is also described as being less work than “playing phone tag” with patients.

The majority of clinicians think that secure messaging does have a positive effect on patient satisfaction and that it could improve the quality of care and patient safety. The most frequently reported barriers to the use of secure messaging for clinicians are communication and information flow, inappropriate use of the health IT application by patients, and poor usability of the application itself. A barrier is the fact that important information about the patient could be missed or misinterpreted via electronic communication.

Providers and nurses both express concern about “missing something important” in a secure message. For example, nurses mentioned that they miss auditory cues that they would have heard on the phone, such as shortness of breath or intonation, and they find it easier to gather information when they can ask the patient questions in person or over the phone. A second important barrier to secure messaging is inappropriate use of the health IT application by patients. Inappropriate use refers to some patients sending overly long messages, messages that are not about medical concerns, messages about a family member using the patient’s portal account (which can raise confidentiality issues), and patients using secure messaging as a means to avoid coming into the clinic.

Poor usability of secure messaging is a third barrier. For example, at one clinic messages are displayed in a confusing format that makes it difficult to find the most recent reply. This problem is exacerbated by patients replying to an old message with information about a new health complaint, instead of starting a new message.

We found many similarities in the facilitators and barriers perceived in secure messaging for staff and clinicians, and also a few differences. The most frequently reported facilitators for staff are communication and information flow, organization of work, and amount of work. Like clinicians, staff appreciate how secure messaging opens up a new channel for patients to communicate with the clinic. They also like that secure messaging has a proxy function that

allows patients to send secure messages on behalf of their children or elderly parents. Secure messaging can reduce the amount of work for staff, because it is easier and faster for them to reply to a secure message than to play phone tag with patients.

The barriers that staff most frequently reported are communication and information flow, amount of work, and ambiguity. Like clinicians, staff perceive barriers related to communication and information flow: they are afraid that they could miss important information when communicating via secure messages. The amount of work can increase when staff must read through a long email to find a single piece of important information. Another barrier staff mentioned is ambiguity. Shared “in-baskets” where incoming secure messages are stored means that sometimes staff are unsure who should address a message and whether someone else is already handling it.

Patients mention many more facilitators to secure messaging than they do barriers. Important facilitators for patients are the organization of work, communication and information flow, and usability. As with clinicians and staff, the asynchronous nature of secure messaging makes it easier for patients to send a message to the clinic. They can send a message whenever it is convenient for them, such as late at night. Patients also appreciate not having to call the clinic and wait on hold. Secure messaging also helps patients with the organization of work. Secure messages are convenient for raising questions that the patient had forgotten to ask during the clinic visit, and help some patients to organize their thoughts.

The third facilitator for patients is usability, with many patients describing secure messaging as easy to use. Patients mention only a few barriers, mostly concerning poor usability. Usability is, therefore, both a facilitator and a barrier for patients. Some patients do not like that they have to open a browser, log in, and if they want to send a message to their provider, search through a list of names to find their provider. Compared with sending an email, using secure messaging involves more steps. The main facilitators and barriers to secure messaging for clinicians, staff, and patients are summarized in Table C, in order of frequency.

Table C. Main facilitators and barriers to secure messaging for clinicians, staff, and patients

	Facilitators	Barriers
<i>Clinicians</i> mention more barriers than facilitators to secure messaging. Clinicians also identify more facilitators and barriers than do staff and patients.	<ul style="list-style-type: none"> • Communication and information flow • Organization of work • Amount of work 	<ul style="list-style-type: none"> • Communication and information flow • Inappropriate use • Usability
<i>Staff</i> identify more facilitators than barriers to secure messaging.	<ul style="list-style-type: none"> • Communication and information flow • Organization of work • Amount of work 	<ul style="list-style-type: none"> • Communication and information flow • Amount of work • Ambiguity/clarity
<i>Patients</i> mention more facilitators than barriers to secure messaging. Patients identify fewer facilitators and barriers than do clinicians and staff.	<ul style="list-style-type: none"> • Communication and information flow • Organization of work • Usability 	<ul style="list-style-type: none"> • Organization of work • Amount of work • Usability

Facilitators and Barriers to e-Forms

Two of the six clinics use e-forms. In one clinic, a care team comprising two providers and a medical assistant (MA) use an e-form to administer a questionnaire to patients with chronic headaches. In the second clinic, two e-forms are used: one to administer a questionnaire about current patient symptoms (Signs and Symptoms), and another to collect data on “patient-reported outcomes” such as health behaviors, depression, and other topics using validated questionnaires.

Our analysis shows that the most frequently reported facilitators to the use of e-forms for clinicians are communication and information flow, organization of work, and amount of work.

One facilitator to communication and information flow is that the output of the e-forms allows the clinicians to quickly assess many aspects of a patient's health. The e-form also improves communication and information flow, because during their conversation with the patient the providers do not have to gather information about topics that have been fully addressed on the e-form, and can therefore spend more time discussing the patient's primary concerns. Use of e-forms can also act as a facilitator to the organization of work for clinicians, because the forms standardize work processes, ensuring that a core set of questions are asked for every patient who completes the form. Also, the information entered on the forms allows providers to easily identify the topics that need to be discussed and those that do not require any discussion in the exam room. A final facilitator to the use of e-forms for providers is that nearly all providers mention that use of the e-forms saves them time, primarily by identifying topics that do not require discussion in the exam room.

The most frequently reported barriers are organization of work, poor usability of the health IT application, and communication and information flow. Barriers with regard to the organization of work were described, particularly regarding administration of the patient-reported outcomes (PRO) e-form. Unlike the other e-forms studied, the PRO e-form is completed by the patient in the examination room. Providers stated they would like to review the information that the patient has entered into the PRO e-form before entering the examination room, but doing so often requires them to wait several minutes for patients to finish completing the e-form. In this situation, some providers choose to enter the examination room without the e-form information, while others wait for patients to finish the e-form even though they perceive the delays as slowing the flow of patients through the clinic.

In contrast with the PRO e-form, the two other e-forms are administered in the waiting room before the patient enters the exam room. The clinicians and staff at both clinics reported that the e-forms completed in the waiting room caused no delays in clinic workflow. The timing and the length of the PRO e-form seems to raise more barriers to the organization of work and the workflow of providers.

A second barrier to the use of e-forms for clinicians is the poor usability of the application. None of the three e-forms allow information to be directly transferred to the electronic health records (EHRs) used in the clinics, which means that extra steps must be taken to ensure that important information is extracted from the e-form and stored in the EHR. With regards to communication and information flow, some clinicians reported that they do not always trust the information that patients provide on the e-form because some patients click responses at random instead of accurately completing the form.

Staff are involved in the workflow related to e-forms in only a limited way, but they nevertheless identified more workflow facilitators than did clinicians or patients. The most frequently reported facilitators are communication and information flow, amount of work, and the organization of work. Staff members appreciate the fact that they are not required to distribute or collect the e-forms, nor document the results in the EHR as would be the case with paper-and-pencil versions of questionnaires. Staff also mentioned that patients feel more comfortable answering some questions using a computer, and answer more truthfully than when the same questions are asked face-to-face.

The most frequently reported barrier to the use of e-forms is poor usability. When there are problems with the technology used to administer the e-forms (for example, the computer freezes or patients have problems with the touch screen), staff must help the patients to complete the forms. If the technical problem cannot be resolved, staff must return to distributing and collecting paper forms, which takes more staff time.

The most frequently reported facilitators to the use of e-forms for patients are communication and information flow, amount of work, and the organization of work. Patients mentioned that they find it easier to complete e-forms than to share the same information verbally face-to-face with staff or clinicians. Many patients also prefer to fill out the forms on a computer rather than on paper, because the font is larger and easier to read, they prefer not to write by hand, and they feel the computers give them more privacy. The most frequently reported problem for patients is poor usability of the e-forms. Patients mentioned that the computer terminals on which they complete the e-forms frequently freeze or break down, and some patients had problems with the touch screens used to complete the Signs and Symptoms and PRO e-forms.

Table D compares the main facilitators and barriers for clinicians, staff, and patients to the use of e-forms. The facilitators and barriers are listed in order of frequency.

Table D. Main facilitators and barriers to e-form use for clinicians, staff, and patients

	Facilitators	Barriers
Clinicians mention more facilitators than barriers to e-forms. Clinicians mention fewer facilitators than do staff, and a similar number of barriers as do staff.	<ul style="list-style-type: none"> • Communication and information flow • Amount of work • Organization of work 	<ul style="list-style-type: none"> • Organization of work • Usability • Communication and information flow
Staff mention more facilitators than barriers. Staff mention more facilitators than do clinicians or patients, and more barriers than do patients.	<ul style="list-style-type: none"> • Communication and information flow • Organization of work • Amount of work 	<ul style="list-style-type: none"> • Usability
Patients mention more facilitators than barriers. Patients mention fewer facilitators and barriers than do clinicians and staff.	<ul style="list-style-type: none"> • Communication and information flow • Organization of work • Amount of work 	<ul style="list-style-type: none"> • Usability

Results show that for clinicians, staff, and patients, one of the most frequently reported facilitators associated with use of e-forms is the positive effect on communication and information flow. The e-forms also help with the organization of work, and reduce the amount of work for clinicians, staff, and patients. All three groups mention more facilitators than barriers, but all indicate that poor usability of e-forms is an important barrier. For clinicians, communication and information flow and the organization of work are also barriers to the use of e-forms.

Facilitators and Barriers to the Use of a Patient Portal To Upload Information

One clinic used only briefly the health IT application that allows patients to upload information through its patient portal; a second clinic still uses this application. In both clinics, patients could upload their blood sugar levels and blood pressure values into their patient portals and share this information with their clinic staff and clinicians.

Clinicians mentioned more facilitators to this health IT application than barriers, mentioning primarily the poor usability of the application as a barrier. The usability of the health IT application does not hinder the clinicians in their own workflow, but they reported it hinders patients. All of the patients in one clinic stopped using the application, as did several of the patients in the second clinic. For clinicians, the application is easy to use, and they mention usability as a facilitator. Other facilitators that clinicians mention are communication and information flow, because patients using this health IT application share useful information about their health with the clinic. Facilitators were also identified related to the organization of work. Nurses stated that if patients do not use upload their information into the clinic's patient

portal, the patients would call the clinic instead and report the information by phone, requiring the nurses to spend time on the phone and document the information in the EHR. With this application, the information is automatically stored in the EHR, in a section for patient-measured blood pressure and blood sugar readings. Staff are not involved in the workflow when patients upload information into the clinic's patient portal, and were unaware of this health IT application in both clinics. The few patients that we interviewed about use of a patient portal to upload information mentioned facilitators related to the amount and organization of work, specifically the amount of time required to share information with the clinic through the portal compared with sharing the information in a phone call. Table E summarizes the main facilitators and barriers to uploading information into a patient portal, in order of frequency.

Table E. Main facilitators and barriers to the uploading of information into a patient portal for clinicians and patients

	Facilitators	Barriers
Clinicians mention more facilitators than barriers to having patients upload information into a patient portal.	<ul style="list-style-type: none"> • Communication and information flow • Organization of work • Usability 	<ul style="list-style-type: none"> • Usability
Staff are not involved in the workflow for this health IT application.	<ul style="list-style-type: none"> • Not applicable 	<ul style="list-style-type: none"> • Not applicable
Patients mention more facilitators than barriers to uploading information into a patient portal.	<ul style="list-style-type: none"> • Organization of work • Amount of work 	<ul style="list-style-type: none"> • Usability

Research Question 2: How does the sociotechnical context influence workflow related to the capture and use of patient-reported information?

Five of the six clinics in the study use secure messaging. One clinic uses two e-forms and, in a second clinic, two clinicians and a medical assistant use one e-form. One clinic in our study previously offered a patient portal for patients to upload information, but had stopped using the health IT application; a second clinic still uses it. Because so few study sites use e-forms or allow patients to upload information into a patient portal, we are unable to examine the impact of the sociotechnical context on workflow for these applications. Our analysis for this section therefore focuses on secure messaging.

Results of our analysis show more similarities than differences in the workflows and in the facilitators and barriers to the use of secure messaging *across clinics*. We identified some differences between clinics that were related to the technological, organizational, and personal aspects of the sociotechnical context.

Technology

For clinics that have implemented a patient portal with secure messaging, the length of time since the system was implemented has an important impact on workflow. Patient enrollment and use of patient portals increases slowly; it takes time for patients to sign up for a patient portal, and it takes even more time before patients actively start sending secure messages to the clinic. This time lag, in turn, has an impact on the volume of messages that patients send and consequently an impact on the workflow. Two clinics in our study have a much larger volume of messages than the other clinics, and the two with higher volume of messages reported more barriers to their workflow than the other clinics.

Organization

A second important factor in the sociotechnical context is the organizational structure of the clinic. Four of the clinics have all implemented a patient-centered medical home (PCMH) model of care in which physicians, mid-level providers, nurses, and medical assistants in these clinics work together in a care team. The remaining clinic that uses secure messaging has a single physician supported by the clinic manager, a medical assistant, a receptionist, and a billing person. Workflow differs when secure messages are addressed by a team, compared with the single physician clinic. In a team-based structure the secure messages are triaged by nurses who distribute them to other team members as appropriate. In contrast, the solo physician triages most messages himself and distributes them to support staff as needed, although patients also frequently contact the clinic via nonsecure email, and messages are triaged and addressed, if possible, by the clinic manager.

A second organizational factor that has an impact on the workflow associated with secure messaging is whether the clinic is part of a larger health care organization or an independent clinic. Larger health care organizations (HCOs) have, in general, more resources for IT implementation and support. Two clinics that use secure messaging are part of larger HCOs and three clinics are independent. Independent clinics have a choice to buy their own EHR with secure messaging, but this limits the ability to share EHR data with other HCOs. Another option for independent clinics is to affiliate with a larger HCO, but in this situation they are dependent for health IT support on the larger HCO, and cannot independently change aspects of the EHR to improve the workflow associated with secure messaging. Also, independent clinics that affiliate with a larger HCO may not have easy access to their EHR data in a format that permits the data to be analyzed so that clinic workflows could be redesigned.

A third organizational factor that has an impact on workflow is the number of part-time staff in a clinic. Part-time staff often do not have as much time to adapt to the workflow related to secure messaging as full-time staff. Also, often part-time staff have less access to training than full-time staff. Unfamiliarity with the health IT application and lack of training in the use of it affect workflow.

Person

Several important factors are related to the characteristics of the person using the health IT applications of interest: job position (i.e., clinician or staff), individual differences within job positions, and characteristics of the patient population. Results of this study have shown that across clinics health IT applications affect the work of clinicians, and more specifically the work of providers, more than the work of clinic staff. However, within clinics, providers differ substantially in their attitudes toward secure messaging: some providers enthusiastically embrace secure messaging and the opportunities it offers for improvement of patient-provider communication. Others prefer not to use it, especially because the time spent on secure messaging is not reimbursed. The providers' preferences also affect how the provider and nurse collaborate. Some nurses read secure messages and, even if they need provider input, first conduct research and route the message with a recommendation to the provider. Other nurses forward nearly all messages to the provider and rarely conduct research first. These differences and individual preferences have an impact on the clinic workflow. Finally, the clinics' patient populations differ. Some clinics have more patients with low socioeconomic status, elderly patients, or patients who do not speak English as their primary language. These patients may be less inclined to use a patient portal for secure messaging, which results in a lower volume of messages and reduces impact on workflow.

Research Question 3: How do clinics redesign their workflow to incorporate the capture and use of patient-related information?

The clinics we studied have not redesigned their workflows to incorporate the capture and use of patient-related information, with two exceptions. One clinic's relatively large volume of secure messages (on average more than 10 secure messages per provider per day) is having an impact on workload of the providers. This fact led two providers to collect data on the volume of secure messages per provider and the time required to address specific types of messages. The clinic uses these data to redistribute the workload among their care teams and to compensate providers who have high levels of messaging-related work.

Another clinic's leaders have examined the data from its two e-forms and learned of important issues affecting its patient population, such as high rates of depression. This realization led to the addition of mental health staff to the care team. Also, use of the PRO e-form has resulted in several changes in the workflow. Researchers at the clinic have conducted several studies, using data collected via the PRO e-form, that involved developing protocols to improve patient care. Successful protocols are sometimes implemented permanently across the clinic. One such protocol involves alerting clinicians if a patient scores higher than a threshold score on suicidal ideation; immediate intervention then occurs to reduce the risk of self-harm. Other protocols have been developed for domestic violence and depression, and more protocols will be developed in the future. These protocols, which are based on information patients report on e-forms, have a direct impact on the workflow in the clinic.

Conclusion

Table F summarizes the main conclusions from this study.

Table F. Overall conclusions related to the three main research questions

	Secure messaging	E-forms	Patient Portal To Upload Information
How does the use of health IT to capture and use patient-reported information support or hinder the workflow from the viewpoints of clinicians, office staff, and patients?	Secure messaging has both negative and positive effects on workflow of clinicians and staff, who identified both facilitators and barriers to workflow. Patients generally reported that secure messaging has a positive impact on their workflow.	E-forms have a generally positive impact on workflow of clinicians and staff, but patients identified more barriers to workflow related to use of e-forms.	Patients uploading information has a positive impact on the workflow of clinicians, who identified mostly facilitators related to the use of this health IT application. Patients are also positive about this application, but identified several usability issues.
How does the sociotechnical context influence workflow related to the capture and use of patient-reported information?	The sociotechnical context influences workflow related to patient-reported information. The impact on clinicians and staff is largely dependent on volume and work organization.	We did not have sufficient data to address this question.	We did not have sufficient data to address this question.
How do clinics redesign their workflow to incorporate the capture and use of patient-reported information?	Most clinics do not redesign their workflow to incorporate the use of secure messaging. However, one study site examined the effect of messaging on workflow and made changes to address issues identified.	Most clinics do not redesign their workflow based on information provided in e-forms. One study site, however, reviewed the information provided by patients through e-forms and made several changes to workflow in response.	Very few patients uploaded information through a patient portal. The clinics studied did not redesign their workflow related to the use of this health IT application.

1. Introduction

Improvements to the quality and efficiency of ambulatory care can be supported by effective implementation of health information technology (IT) systems, with concomitant changes in the workflow of care delivery. The relationship between health IT and care delivery workflow is not well understood. However, it is of such importance that a major focus of the \$721 million Health Information Technology Regional Extension Center program included supporting ambulatory care providers implementing electronic health record (EHR) systems,²⁸ through the analysis and redesign of clinic workflows.²⁹ Clinicians and health systems are challenged to skillfully implement health IT in a way that maximizes benefit and minimizes disruption. To address this need, AHRQ previously funded the development of a toolkit for assessing the impact of health IT on clinical workflow.³⁰ This study builds on this previous work and uses a rigorous research design to examine the impact of a critical and under-researched area of health IT—patient-reported information—and the impact on clinical workflow in ambulatory care settings.

1.1 Health IT Implementation

During the last 20 years health care organizations (HCOs) have slowly started to implement health IT, which can improve the quality of care and patient safety.³¹⁻³⁵ However, health IT implementation has been difficult or even failed,³⁶ has met with high user resistance, and has contributed to safety problems.^{33,37,38} Progress toward full EHR adoption has been spurred by Medicare and Medicaid EHR Incentive Programs funded by the American Recovery and Reinvestment Act of 2009, and nearly half of U.S. hospitals had implemented an EHR by 2013,³⁹ as well as 69 percent of primary care clinics.⁴⁰

1.1.1 Health IT Applications That Allow Patients To Share Information Electronically

The implementation of EHR systems gives health care providers access to patient medical records electronically and also creates the possibility for patients to access these records and provide information electronically to the clinic, for example through a patient portal. Patient portals may include several functionalities for patients, depending on the type of patient portal and the modules that a clinic has implemented:

- Accessing medical records (e.g., medical history, health issues, medication list, test results, care plans, allergy list)
- Sending a secure message to their health care provider(s)
- Uploading clinical information and telemetry (e.g., blood pressure, blood glucose values, and weight measured at home)
- Completing forms electronically instead of on paper (e-forms)
- Accessing a child or elderly parent's records (proxy access)
- Scheduling appointments
- Requesting medication refills
- Accessing billing records
- Paying bills online

According to a 2014 study, between 22 percent and 28 percent of primary care clinics have implemented a patient portal, and 25 percent of patients use patient portals if they are available.⁴¹ One of the objectives to achieve Meaningful Use (Stage 2) for certified EHR technology is to provide patients with the ability to electronically view, download, and transmit their health information within four business days of the information being available to the eligible professionals (EP).⁴¹ The goals are (1) to have more than 50 percent of patients seen by an Eligible Practitioner be provided timely online access to their health information, and (2) to have more than 5 percent of patients seen by the Eligible Practitioner view, download, or transmit to a third party their health information.⁴¹

Some of the functionalities described above (e.g., e-forms) may also be implemented as stand-alone systems that are not integrated with an EHR.

1.2 Study Goals

The fact that patients can provide information electronically to their primary care clinic affects the way work is organized within the clinic. However, relatively little is known about how patients' use of these health IT applications affects clinic workflow.

In this study we focus on health IT applications that patients use to provide information electronically to the clinic, and examine the impact of this patient-provided information on clinic workflow. We focus on the following three health IT applications:

- Secure messaging
- Electronic forms (e-forms)
- Use of a patient portal to upload information

We use a multiple case study design to assess the impact of these health IT applications on workflow in the clinic and examine the impact of the clinic sociotechnical context on the use of these health IT applications. Our study addresses three research questions:

1. How does the use of health IT to capture and use patient-reported information support or hinder the workflow from the viewpoints of clinicians, clinic staff, and patients?
2. How does the sociotechnical context influence workflow related to the capture and use of patient-reported information?
3. How do clinics redesign their workflows to incorporate the capture and use of patient-related information?

2. Background

2.1 Literature on Patients Providing Information Electronically

Several reviews have assessed and summarized studies on patients providing information electronically. A 2012 study by Goldzweig et al.¹ reviewed the literature published between 1999 and 2010 on patient access to their own medical record, patient self-reported data, secure messaging and online reminders, and the relationship of these health information technology (IT) applications with health outcomes, patient satisfaction, adherence, efficiency or utilization, and attitudes about access. This review found low-to-moderate evidence that patient access to their own records and secure messaging can improve health outcomes (e.g., blood sugar control in patients with diabetes); adherence (e.g., rate of colorectal cancer screening), and patient satisfaction. The authors conclude that health IT is a tool that—if implemented by itself—may have only modest impact, but that health IT implementation as part of a more comprehensive program can improve quality of care.

In 2014, De Lusignan et al.² used the review by Goldzweig et al. as a basis to conduct a systematic interpretative review of patient online access to their medical records and other online services, excluding studies of health IT systems that provided patients with online access for a single condition or disease (e.g., diabetes). Results of this systematic review show that (1) patients' adoption of access to their medical records has been slow, (2) there is no evidence of improved health outcomes, but (3) there may be benefits to patient safety, mainly through the identification of medication errors and adverse drug reactions (e.g., Schnipper et al.³ and Ralston et al.⁴), improved patient experience and patient satisfaction in part through better self-care (e.g., Fisher et al.⁵ and Saparova⁶), and improved patient-provider communication.^{7,8} Relatively few studies have examined the impact of patient-provided information on workflow in the clinic.

Ammenwerth et al.⁹ published a systematic review in 2012 on the impact of patient portals on patient care, including only studies with a controlled experimental or quasi-experimental design. This review found only four studies that met the strict inclusion criteria,⁹ and its results confirm those of other reviews.^{1,2} No evidence was found of improved health outcomes such as reductions in mortality or hospitalizations, but intervention groups who had access to a patient portal scored better than the control group on medication adherence¹⁰ and adherence to medical advice.¹¹ Grant et al.¹⁰ conducted a randomized controlled trial in 2008 on the impact on type 2 diabetes patients of online personal health record (PHR) systems maintained by the patients, which included secure messaging and also enabled patients to write a diabetes care plan. Note that a patient portal gives patients limited access to records in their provider's electronic health record (EHR), which is a systematic collection of electronic health information about an individual patient or population⁴² that is available instantly and securely to authorized users⁴³ and is maintained by clinicians and staff. Results of the study by Grant et al. show that patients in the intervention group, who had access to secure messaging and a PHR, had a higher overall rate of changes in their medication and medication dosage adjustments than patients in the control group. Ross and colleagues¹¹ also conducted a randomized controlled trial to examine the impact of online PHR (including secure messaging) on congestive heart failure patients. Results of their study showed that patients in the intervention group scored higher on self-reported adherence to medical advice.

2.2 Literature on Workflow

Workflow can be defined as the flow of work through space and time, where work is composed of three components: *inputs transformed into outputs*.^{30, 44} People move through space and time; so does information in paper and electronic formats, and so do objects such as computer tablets, smart phones, and paper forms.⁴⁵ Depending on system design, patients may contribute information from their homes or other locations, or while in a medical setting. There are various levels and times at which patient-reported information (e.g., blood sugar measurements) can be collected (inputs) and transformed to yield both immediate outputs (e.g., changed insulin dosage) and ultimately patient health outcomes (e.g., better glycemic control). At each level, technical factors, roles, relationships, and other system factors may affect workflow.⁴⁶

At a *macro level*, there is workflow among ambulatory, community, and patient settings, such as the workflow when a provider and a patient exchange secure email messages about altering a medication and the clinician forwards a new prescription to a community pharmacy, where the prescription is filled by the pharmacist and picked up by the patient. *Clinic-level* workflow is embedded within the macro level and relates to the flow of a provider, nurse, or patient through the clinic's physical space, and the flow of information, in paper or electronic format, among people at the clinic. Workflow during a patient visit is especially important, to maximize the brief opportunity for interactive questions and answers. Patients might be asked to share health information with the rooming staff, such as about specific behaviors (e.g., smoking), which is then included in the EHR and displayed for the clinical team. Finally, at the most *micro level*, there is clinician cognitive workflow during a visit with a patient, which is the flow of thoughts, questions, information processing, and clinical decisions.

Workflows related to health IT vary depending on a clinician's role (e.g., nurse, provider, therapist, or pharmacist) and the voluntary actions of patients. Even clinicians who share a role and work together may vary considerably in how they are able and willing to use health IT to incorporate patient-reported information. If, for example, one provider may discourage patients from using secure messaging, while another embraces the health IT application for selected patients, their workflows will be different.

Changes in workflow can affect the way work is organized in the clinic, how work is distributed among the different health care providers in the clinic, task complexity and workload, and communication within the clinic. All of these factors can affect job satisfaction, quality of care, and patient safety.

2.3 Patient-Provided Information and Workflow in Sociotechnical Context

In most studies that address use of health IT in ambulatory settings, workflow is not the main focus of the research.^{30,47} Much of the literature on workflow consists of descriptive studies, and authors often ignore sociotechnical factors, such as patient or provider characteristics, the physical environment and layout, technical training and support, functionality and usability of health IT applications, worker roles, and communication flows. Important research that does address such factors comes mainly from inpatient settings, or from other countries where the health care system is quite different than in the U.S.⁴⁸⁻⁵¹ The effects of sociotechnical factors on the relationship between health IT and workflow is thus not yet well understood.⁵²

Specifically, few studies have examined the impact of patient-provided information on workflow. Liederman and colleagues¹² examined the impact of secure messaging on patient, provider, and staff satisfaction, and on provider message volume. The authors concluded that uptake of secure messaging was slow; one year after implementation, 6,394 patients were enrolled in secure messaging out of a patient panel of 135,000 patients (4.7 percent). These patients sent 6,731 messages in 6 months; fewer than 21 percent sent four or more messages; 34 percent sent two or three messages and nearly half (45 percent) sent a single message.

Several studies have examined reasons why uptake of patient portals and secure messaging is so low among patients. For example, Goel et al.¹³ identified patient-reported barriers to enrollment, showing that 26 percent of patients did not remember having discussed a patient portal with their providers, 6 percent did not attempt enrollment despite remembering the discussion, and 11 percent attempted to enroll but did not succeed.

Several studies examined the impact of patient portals on workload. According to the systematic literature review by de Lusignan et al.,² the impact of patient portals is not consistent: seven studies reported an increase in workload (e.g., Palen et al.¹⁴); two studies reported a temporary increase in workload that afterwards plateaued (e.g., Liederman et al.¹²); and eight studies reported a reduction in workload (e.g., Ye et al.⁷). However, in most of these studies workload was measured at the *clinic level* (e.g., volume of secure messages compared with telephone call volume), and not at the individual level. In other words, it is difficult to determine whether providers or staff experienced a change in their workload, or both. Some studies examined the volume of secure messages per provider. For example, a study on patient portal use in Finland showed that, on average, patients used the electronic messaging system only six times a year.¹⁵ A study by Lin et al.¹⁶ found that providers received on average one message per day from 250 patients with access to secure messaging. Several studies show that volume of secure messages is low (approximately two secure messages per day per provider), and that providers each spend about 5-10 minutes a day responding to them.^{12,17,18}

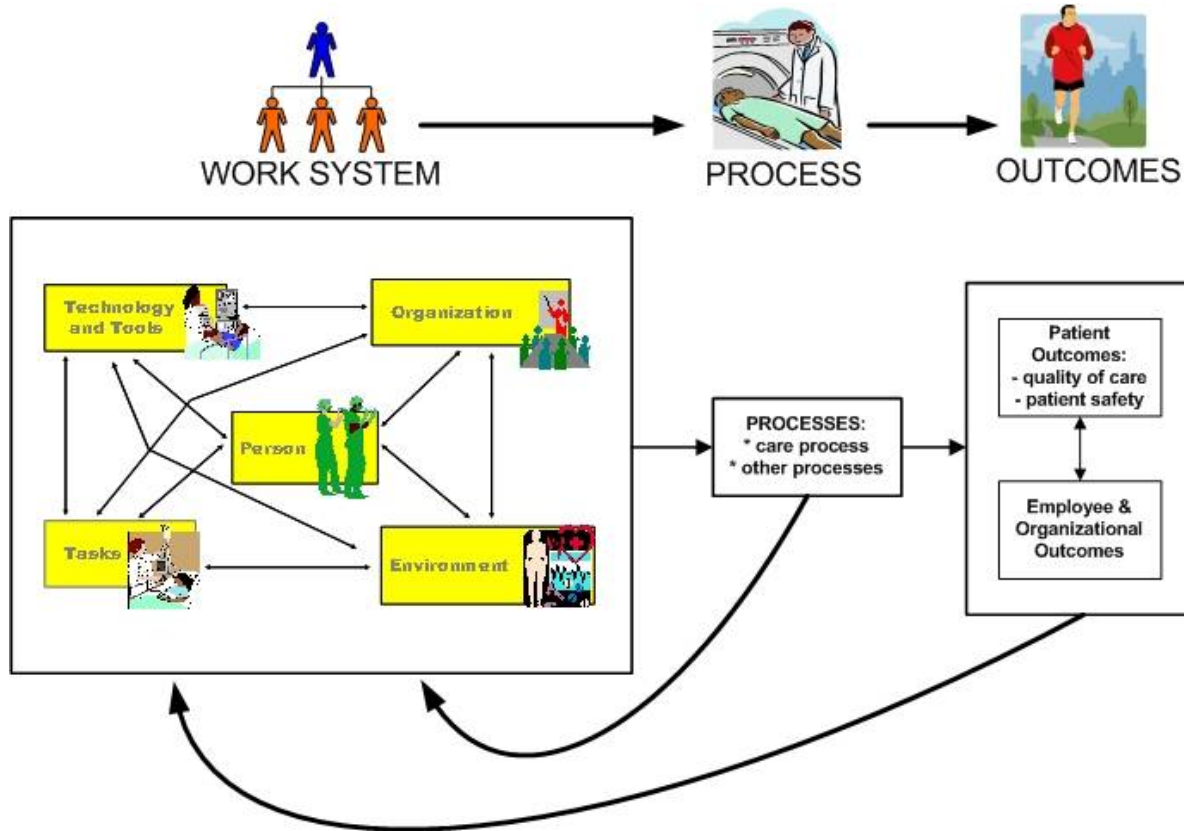
Several studies examined the effect of the information that patients provide electronically on communication. Many studies focus on the volume of patient-provider communication, but some studies have also examined the quality of the communication. In a systematic review, Ye et al.⁷ examined the role of secure messaging in patient-provider communication. The benefits of secure messaging were recognized by both patients and providers, and several studies concluded that secure messaging has great potential to improve patient-provider communication (e.g., Katzen et al.,¹⁹ Leong et al.,²⁰ and Virji et al.²¹). Some of the studies in the review analyzed the content of the secure messages exchanged between patient and provider. Most of the secure messages were about nonacute issues, but a study by Rosen and Kwoh²² found that nearly 6 percent of secure messages were urgent, and 0.002 percent required a physician's immediate attention. Several studies examined the characteristics of secure messages and noted that messages were mostly brief, formal, and medically relevant.²³⁻²⁵ The study by Roter et al.²³ compared the content of the messages sent by patients with those sent by providers to their patients. Provider messages in general were shorter and more direct than patient messages. Patients were generally satisfied with secure messaging.^{19,20}

2.4 Conceptual Framework

In this study, we examine the impact on workflow of health IT applications to capture and use patient-reported information, and we include the larger sociotechnical context. That also means that we collect data not only from providers, but also from nurses, clinic staff, and patients. To explore the sociotechnical context in which health IT related to patient-reported

information is used, the study uses the work system model developed by Carayon and Smith,^{53,54} and its extension, the System Engineering Initiative for Patient Safety (SEIPS) model shown in Figure 1.⁴⁶

Figure 1. SEIPS work system model



The SEIPS model is a valuable framework for examining the impact of health IT on clinical workflow, especially for patient-reported information, because the model recognizes the interdependent nature of the five major aspects of a work system: a *person* performing various *tasks* using *tools and technology* in a given *environment* within an established *organization*. In this study, our focus is on the impact of the technology element on the rest of the work system and subsequent outcomes. We assess workflow barriers and facilitators related to various elements of the work system and their consequences for clinicians, staff and patients. In addition, we use the work system model to guide our analysis of the sociotechnical context (i.e., the five aspects of a work system) in which technologies are implemented and used.

3. Methods

3.1 Study Design

This study uses a multiple case study design with mixed methods for data collection.^{26, 27} The six participating clinics (i.e., six cases) were primary care clinics located in medium-sized cities, two located in the Southeastern United States and four in the Midwestern United States. One limitation of our research is that our multiple case study design included only six cases, which limits the generalizability of our findings.

3.2 Terminology

Table 1 contains terms and definitions that are used in this report to refer to clinic staff and clinicians. Note that these terms are not mutually exclusive.

Table 1. Terms referring to clinic members

Term	Definition
Clinic manager	A staff member or nurse who is responsible for direction and coordination of the clinic's day-to-day operations
Clinician	A provider or nurse
Medical assistant (MA)	A medical assistant (MA), certified medical assistant (CMA), or person in a similar role as; a nonclinical staff member, primarily responsible for rooming patients
Nurse	A registered nurse (RN) or licensed practical nurse (LPN)
Physician leader	The clinic physician identified as being most knowledgeable about health IT and health IT implementation
Provider	A physician, physician assistant (PA), or nurse practitioner (NP)
Staff	Clinic staff who are not a clinicians, such as receptionists, schedulers, MAs, and social workers
Triage nurse	A registered nurse (RN) who evaluates the needs of patients contacting the clinic and ensures that those patients are given appropriate medical treatment by gathering information, providing advice, scheduling further care, and communicating with other members of the care team

3.3 Study Sites

Study sites were identified through the practice-based research network of a Southeastern State and through professional networks of the researchers. Clinics were targeted for recruitment if they provided primary care, used one or more health IT applications that allowed patients to report information electronically, and were either small (4 or fewer full-time physicians^{*}) or medium-sized (5–10 full time physicians). Clinics were excluded from consideration if they had not been using at least one health IT application of interest for 12 months prior to data collection. Participating clinics were paid a \$5,000 stipend.

At the outset of this study, the plan was to recruit two clinics in the Midwest to participate in the research and four clinics in the Southeast. However, recruitment was difficult and instead data were collected in four clinics in or near a medium-sized Midwestern city and two in a Southeastern city. Health care in the Midwestern city is dominated by three large health care

^{*} The numbers of physicians were counted in full-time equivalents (FTEs). Thus, two physicians each working 20 hours a week were counted as 1 FTE physician for the purpose of determining the clinic's size.

organizations (HCOs) that use Epic Systems EHRs with patient portals. The independent clinics studied were not able to purchase similar systems directly from Epic, and therefore purchased Epic EHRs through one of the local large HCOs. The EHR vendors used by HCOs in the Southeastern city are more varied. Clinic 2 was an early adopter, implementing an EHR from Bizmatics, a small vendor, in 2005, including a patient portal with secure messaging. The other Southeastern clinic had used a homegrown EHR for many years before implementing a Cerner EHR 2 years before study data collection. Each of the six clinics is described below, and clinic characteristics are summarized in Table 2.

Clinic 1 is a medium-sized internal medicine clinic located in the Midwest. It has seven physicians and four PAs, and has implemented a patient-centered medical home (PCMH) model of care, with staff organized into four care teams. The clinic is one of over 20 primary care clinics owned by the HCO, and has existed for 20 years. The clinic has a patient population of 14,000, which has been growing over time. The patient population served by this clinic is elderly, and many patients have chronic medical conditions. Insurance payers include Medicare (55 percent), Medicaid (5 percent), and a health insurance plan affiliated with the HCO (40 percent).

Clinic 2 is a small family medicine clinic in the Southeast, staffed by one physician, who owns the clinic. The clinic has existed for nine years and has a regular patient population of 4,500, with an estimated 1,500 additional patients who come to the clinic infrequently. Clinic patients are mostly adults between the ages of 18 and 55, with 10 percent of patients on Medicare and 15 percent pediatric patients. Most patients have Blue Cross or other private insurance; the clinic does not accept Medicaid and has few self-paid patients.

Clinic 3 is a small family medicine clinic in the Midwest. It is part of an HCO with seven primary care clinics. The clinic implemented a patient-centered medical home model of care, and is organized into two care teams. It was founded less than 2 years before study data were collected, and the patient panel is relatively small (2,400 patients). The clinic has a few Medicaid patients (5 percent) and many covered by Medicare (25 percent). Most other patients are covered by a health insurance plan affiliated with the HCO.

Clinic 4 is a medium-sized primary and specialty care clinic for HIV patients in the Southeast. Owned by a public university, this clinic has existed for 27 years, and it recently added 800 new patients after a nearby HIV clinic closed. Clinic providers include 13 attending physicians, 10 infectious disease fellows, and 6 nurse practitioners (NPs). All physicians work in the clinic part time. The clinic staff also includes eight social workers, two nutritionists, and three mental health professionals to help meet the needs of their patient population. The clinic implemented a PCMH model of care and is organized into care teams consisting of an attending physician, a fellow or PA, and an MA. Nearly one-third of the clinic's 3,000 patients (30 percent) are low-income and uninsured and have their medical costs covered by grant funding. Of the other patients, Medicaid covers 13 percent, Medicare 27 percent, and the remaining 30 percent have private health insurance.

Clinic 5 is a medium-sized internal medicine clinic in the Midwest. Founded in 1946, this independent clinic is owned by its physician partners. This clinic also implemented a PCMH model of care. Clinic staff include seven physicians, who are organized into three care teams. Of the 7,200 patients seen each year, over 30 percent are covered by Medicare and most of the rest have private health insurance.

Clinic 6 is a small clinic that has provided primary care to low-income and underinsured patients in the Midwestern city for 10 years. It is a federally qualified health center (FQHC) owned by a nonprofit foundation. Of the 5,000 clinic patients, most are covered by Medicaid (50 percent) or are uninsured (40 percent), and pay reduced prices for health care on a sliding scale.

Other patients are covered by Medicare (5 percent) and private insurance (5 percent). Clinic providers are eight part-time physicians, one physician's assistant, and one nurse practitioner. The clinic also has mental health staff on site. The clinic implemented a PCMH model of care and is organized into care teams composed of a physician or PA with an LPN or MA. Triage functions are performed by a pod of four RNs. Clinic patients vary in age: 40 percent are children and 10 percent are elderly. Many clinic patients are not native English speakers; 40 percent are Spanish-speaking and 10 percent speak another language.

Table 2. Description of participating clinics

	Clinic 1	Clinic 2	Clinic 3	Clinic 4	Clinic 5	Clinic 6
Type of clinic	Internal medicine	Family medicine	Family medicine	Specialty and primary care	Internal medicine	Family medicine
Size	Medium	Small	Small	Medium	Medium	Small
Location	Midwest	Southeast	Midwest	Southeast	Midwest	Midwest
Years in existence	> 20 years	> 8 years	1.5 years	>27 years	> 60 years	10 years
Clinic staff:						
Clinic manager	1 (staff)	1 (staff)	1 (RN)	1 (NP)	2 (staff and RN)	1 (RN)
Physicians	7 (6 FTE)	1	3	23 (5 FTE)	7 (6 FTE)	8 (3 FTE)
PAs and NPs	7	0	0	6	1	2
RNs	6	0	1	6	11	6
LPNs	2	0	0	2	0	6
MAs	7	1	2	4	4	2
Social workers	0	0	0	8	0	0
Schedulers	7 (shared)	1	3	5	8 (shared)	3
Other staff	7	1	0	19	1	5
Patients	~14,000	~4,500	~2,500	~3,000	~7,200	~5,000

The clinics use three types of health IT applications for patients to report information electronically: secure messaging, e-forms, and uploading of information through a patient portal. Table 3 describes the health IT applications each clinic uses. The four Midwestern clinics use similar versions of the Epic EHR and patient portal software. Two clinics (Clinics 3 and 5) have identical software, because Clinic 5 purchased software from the HCO that owns Clinic 3. At the time it was founded, the physician owner of Clinic 2 researched and selected a relatively simple and inexpensive EHR, Bizmatics Prognosis. Clinic 4 uses an EHR product from Cerner and was preparing to implement a patient portal a few months after data were collected. The health IT applications studied are described in more detail in Sections 4.1.1 (secure messaging), 4.2.1 (e-forms), and 4.3.1 (uploading information into a patient portal).

Table 3. Description of health IT applications used in each clinic

	Clinic 1	Clinic 2	Clinic 3	Clinic 4	Clinic 5	Clinic 6
EHR	Epic	Bizmatrics Prognosis	Epic	Cerner Millennium	Epic	Epic
Secure messaging	Yes	Yes	Yes	No	Yes	Yes
Electronic forms	Yes— returning migraine patients	No	No	Yes— (1) current symptoms (2) patient- reported outcomes	No	New— pre-visit questions sent to portal users*
Uploading information through patient portal	No	No	Previously— blood pressure and blood glucose readings*	No	Yes— blood pressure and blood glucose readings	No

* For some parts of our analyses, the data for these health IT applications were too limited to warrant inclusion (e.g., a single clinic interviewee had used the application a few times).

3.4 Data Collection Procedures

Before beginning data collection, this research was approved by the institutional review boards (IRBs) of the University of Wisconsin-Madison and the University of Alabama at Birmingham. The Abt Associates IRB deferred review to the University of Wisconsin IRB. The Office of Management and Budget (OMB) also approved all data collection activities, as required by the Paperwork Reduction Act.

3.4.1 Preliminary Conference Call and Pre-Visit Questionnaire

After each clinic agreed to participate, we held a preliminary conference call to explain the research study and discuss logistics for the site visit (see preliminary conference call guide in Appendix A). After the call we sent a pre-visit questionnaire (see Appendix B) to the clinic manager. The pre-visit questionnaire was used to obtain general information about the clinic, such as when the clinic was founded and the number of patients (see Table 2). After the pre-visit questionnaire was returned, the research team requested interviews with clinicians, staff, and patients, and obtained contact information necessary in order to distribute the Web-based survey.

3.4.2 Clinic Visit

Each of the six clinic visits consisted of five types of activities:

- a clinic tour with the clinic manager
- an interview with the clinic manager
- an interview with the physician leader
- interviews with clinicians and staff
- observations of clinicians and staff
- interviews with patients

The schedules for the site visits are in Appendixes C-H.

3.4.3 Clinic tour

The first 15–60 minutes (depending on clinic size) of a clinic visit were spent on a clinic tour. The clinic manager walked the research team through the building, showing all parts of the clinic

including the reception area, waiting room, providers' offices, nursing stations, and patient exam rooms. If the clinic had a laboratory, imaging services, or pharmacy, the tour included these. (See Appendix I for the clinic tour guide.)

3.4.4 Interviews and Observations

In total, we conducted 110 interviews and/or observations, for a total of 89 hours of data collection. See Appendix J for details about the data collected in each clinic.

3.4.4.1. Interview with clinic manager. After the clinic tour, researchers interviewed the clinic manager. Using the interview guide for the clinic manager (see Section 3.5.4.1 and Appendix K) the researchers asked the clinic manager about the overall background of the clinic: the history, type of patients, organization of work, workflow, and health IT. If possible, the clinic manager provided a demonstration of the health IT system used in the clinic, particularly the health IT applications for patient-provided information. The clinic manager was asked about the impact of implementation of health IT to capture and use patient-reported information on clinical workflow, and what changes had occurred in the clinic as a result of the health IT implementation. Further, questions were asked about facilitators and barriers to health IT. Finally, the clinic manager was asked if the implementation of the health IT application provided opportunities for clinic redesign. We conducted five clinic manager interviews. One clinic manager (at Clinic 3) had only briefly filled the role of interim clinic manager, so we instead interviewed her about her prior position at the clinic as a triage nurse. On average, the interviews with the clinic manager lasted 80 minutes.

3.4.4.2. Interview with physician leader. Researchers also interviewed the physician leader in each clinic, who was identified by the clinic manager or other clinic leadership in the pre-visit phone call as being most knowledgeable about health IT and health IT implementation. Using the appropriate interview guide (see Section 3.5.4.2 and Appendix L), researchers asked questions about the history and current status of health IT; support related to health IT; future plans for health IT implementation; facilitators and barriers to workflow related to health IT; and the impact of health IT on the clinic. The physician leader was also asked about opportunities for redesign of work and workflow in the clinic. We conducted four physician leader interviews. Clinic 2 has only a single physician and the physician leader in Clinic 3 was ill and unavailable to participate in the interview. On average the interviews with the physician leaders lasted 57 minutes (see Appendix J).

3.4.4.3. Interviews with clinicians and staff. In total, we conducted 62 interviews with clinicians and staff, using the interview guide (see Section 3.5.4.3 and Appendix M). See Appendix J for details about these interviews across the six clinics. In many cases, interviews and observations were conducted concurrently.

3.4.4.4. Observations with clinicians and staff. In total, we conducted 68 observations with clinicians and clinic staff, using the observation data collection form (see Appendix N). Often observations were conducted concurrently with the interviews with clinicians and staff. See Appendix J for details about this data collection in each clinic. We took detailed notes using the observation data collection form, and used the data from the observation to create workflow process maps—diagrams that show the temporal sequencing of tasks in relation to other work system elements (person, organization, environment, and tools and technologies).

3.4.4.5. Interviews with patients. In total, we conducted 33 interviews with patients. (See Section 3.5.4.5 and Appendix O for the patient interview guide.) Details about the patient interviews in each clinic appear in Appendix J. We aimed to interview six patients in each clinic, but in Clinics 2 and 6 we were not able to find enough patients who used the health IT applications of interest and would agree to participate in an interview. In Clinic 5 we interviewed

seven patients so that we could collect sufficient data from patients who were current or former users of the application to upload information through a patient portal. On average, the interviews lasted 13 minutes.

3.4.5 Web-Based Survey

A questionnaire was developed to measure end-user satisfaction with the different health IT applications. (See Appendixes P and Q and Section 3.5.5 for more details about the structure and content of the survey.) During the pre-visit conference call, the clinic manager was asked for the email addresses of all clinic employees who use one or more of the health IT applications of interest. Several days before the actual clinic visit, the clinic manager or physician leader sent an introductory email to the employees who would receive the survey, to notify them about it. On the second day of the clinic visit, these employees received an invitation to participate in the survey (see Appendix R), followed by three reminders, respectively two, five, and seven days after the initial invitation. This procedure resulted in an overall response rate of 78 percent (see Table 4).

Table 4. Surveys distributed, responses, and response rates for the Web-based survey

Clinic	Surveys distributed	Response	Response rate
Clinic 1	42	37	88.1%
Clinic 2	5	5	100.0%
Clinic 3	11	7	63.5%
Clinic 4	49	33	67.3%
Clinic 5	28	21	75.0%
Clinic 6	17	15	88.2%
Total	152	118	77.6%

3.4.5.1. Survey respondents. In total, 118 respondents who work in the six clinics completed the survey. The characteristics of the respondents are summarized in Tables 5–8.

Table 5. Job characteristics of survey respondents by clinic

Job title	Clinic 1 (n=37)	Clinic 2 (n=5)	Clinic 3 (n=7)	Clinic 4 (n=33)	Clinic 5 (n=21)	Clinic 6 (n=15)	Total (N=118)
Clinic Manager	1	1	0	0	0	0	2
Physician	4	1	2	12	6	6	32
PA or NP	6	0	0	5	1	1	14
Nurse	8	0	2	6	10	7	33
Medical Assistant	4	1	1	2	2	0	10
Social worker	0	0	0	8	0	0	8
Receptionist/ Scheduler	8	1	2	0	0	0	11
Patient care assistant	3	0	0	0	0	2	5
Other	4	1	0	0	0	0	5
Mean hours worked per week	40.7	36.0	38.4	48.0	39.3	30.4	40.9
Mean years of tenure in clinic	6.7	7.2	8.2	5.6	5.3	5.5	6.1

Most survey respondents were nurses (28 percent) or physicians (27 percent). On average, respondents worked slightly more than 40 hours per week, but in some clinics (e.g., Clinics 4 and 6) many clinicians work part-time. On average, respondents had over 6 years of tenure at their clinic.

Table 6 describes the personal characteristics of the survey respondents in each clinic. The majority of respondents (80 percent) were female. Respondents varied widely in age, with 29 percent younger than 35 years old, 25 percent aged 35–44 years, 21 percent aged 45–54 years, and 25 percent aged 55 years or older. The majority of the respondents (74.1 percent) rated themselves as average computer users (able to use word processing software, spreadsheets, email and the Internet); two respondents (1.8 percent) considered themselves to be novice users; and 22.9 percent of respondents considered themselves to be advanced users (able to install software and set up configurations). On average, the respondents had nearly 16 years of computer experience.

Table 6. Personal characteristics of survey respondents by clinic

	Clinic 1 (n=37)	Clinic 2 (n=5)	Clinic 3 (n=7)	Clinic 4 (n=33)	Clinic 5 (n=21)	Clinic 6 (n=15)	Total (N=118)
Gender (female)	88.6%	80.0%	85.7%	72.7%	84.2%	71.4%	80.5%
Age:							
<35	40.0%	0%	28.6%	18.2%	47.4%	14.3%	29.2%
35–44	14.3%	40.0%	14.3%	33.3%	10.5%	50.0%	24.8%
45–54	22.9%	60.0%	28.6%	9.1%	21.1%	28.6%	21.2%
≥55	22.9%	0%	28.6%	39.4%	21.1%	7.1%	24.8%
Computer skills:							
Novice user	2.9%	0%	0%	0%	0%	7.1%	1.8%
Average user	67.7%	100%	71.4%	78.8%	63.2%	85.7%	74.1%
Advanced user	29.4%	0%	28.6%	21.2%	36.8%	7.1%	24.1%
Mean years of computer experience	15.4	14.0	15.4	17.4	15.7	13.5	15.8

Table 7 summarizes respondents’ use of health IT. All the clinics are actively using an EHR, though some respondents reported that they did not use it personally. All the clinics except Clinic 5 use secure messaging (see Section 4.1.1 for a description of the health IT applications used.) Clinics 1, 2, 4, and 6 have implemented some type of e-form (see Section 4.2.1 for more information about the applications). Some respondents may have misunderstood the questions being asked, or responded thinking about their work with a health IT application at another hospital or clinic. For example, Clinic 2 does not have access to any form of health information exchange, but two staff responded that they used this application, perhaps misinterpreting the terminology. Also, Clinic 4 has not yet implemented a patient portal or secure messaging, but all of the physicians responded that they use this type of application. All physicians work in this clinic part-time and may have responded affirmatively because they use this application elsewhere.

Table 7. Respondents’ use of health IT by clinic

Do you use:	Clinic 1 (n=37)	Clinic 2 (n=5)	Clinic 3 (n=7)	Clinic 4 (n=33)	Clinic 5 (n=21)	Clinic 6 (n=15)	Total (N=118)
Electronic health records (EHR)	97.3%	100%	100%	93.9%	95.2%	100%	96.6%
Health Information Exchange (HIE)	51.4%	40.0%	100%	3.0%	95.2%	80.0%	51.7%
Secure messaging	83.8%	40.0%	71.4%	15.2%	66.7%	66.7%	56.8%
e-Forms	32.4%	40.0%	14.3%	78.8%	0%	6.7%	35.6%

Results in Table 8 indicate that not all respondents received training on key types of health IT. This partly reflects the fact that some clinics have not implemented all types of health IT, and partly reflects the fact that some health IT applications are not used by all clinic staff. However, some clinics have implemented health IT systems that are used by all survey respondents (e.g., secure messaging in all sites except Clinic 4) for which not all clinicians and staff have received training. This is notably the case in Clinic 6, where many clinicians work part-time and have received little health IT training.

Table 8. Training received for health IT by clinic

	Clinic 1 (n=37)	Clinic 2 (n=5)	Clinic 3 (n=7)	Clinic 4 (n=33)	Clinic 5 (n=21)	Clinic 6 (n=15)	Total (N=118)
Electronic Health Records (EHR)	100%	80%	100%	54.5%	90.5%	100%	84.7%
Health Information Exchange (HIE)	43.2%	0%	85.7%	3.0%	61.9%	53.3	37.3%
Patient Portal	81.1%	60.0%	71.4%	9.1%	52.4%	60.0%	51.7%
Secure Messaging	81.1%	20.0%	71.4%	9.1%	42.9%	40.0%	45.8%
e-Forms	13.5%	20.0%	0%	57.6%	0%	0%	21.2%

3.4.6 Post-Visit Followup Call

Following each site visit, researchers completed workflow process maps for each health IT application used at the study site, and sent them to the clinic manager and physician leader, requesting confirmation that the understanding of their workflows was correct. A one-hour conference call was scheduled to review the workflow process maps. The review was conducted using the postvisit followup call guide, included as Appendix S.

3.4.7 Additional Data Collection

During the interviews, we asked clinicians and staff how many secure messages they received, and we asked patients how many messages they typically sent in a given period. Responses varied greatly for two reasons. First, there is considerable variation in how often clinicians, staff, and patients use secure messaging. Second, research participants are generally not very good at estimating how often a certain event occurs. To receive more-reliable data about secure messaging volume, we asked clinic managers to download the number of secure messages the clinic had received in the previous week, if possible. Clinic managers also provided us with additional information about work processes in the clinic and functionalities of a health IT application, such as brochures, PowerPoint presentations, and training handouts.

3.5 Data Collection Tools

Several data collection instruments were used in this research. Each is described below.

3.5.1 Preliminary Conference Call Guide

The preliminary conference call guide (see Appendix A) describes the topics that were discussed in the preliminary conference call with the clinic manager and/or physicians leader, including goals of the study; the definition of patient-reported information; the site visit schedule; types of questions in the interviews with clinicians, staff, and patients; and the postvisit followup call.

3.5.2 Pre-Visit Questionnaire

The pre-visit questionnaire (see Appendix B) consists of 16 questions about characteristics of the clinic (e.g., type of clinic, staff, and number of patients); the health IT in use at the clinic (e.g., number of patients actively using secure messaging); implementation of health IT (including questions about workflow and support during implementation); and satisfaction with the different types of health IT applications.

3.5.3 Clinic Tour

Each of the six site visits began with a one-hour tour of the clinic and discussion with the clinic manager to observe the physical layout and computer work stations, clarify the purpose of the study and the site visit, and clarify information from the pre-visit questionnaire. The clinic tour guide is included as Appendix I.

3.5.4 Interviews and Observations

Five types of data collection were conducted during clinic visits:

- Interview with clinic manager
- Interview with physician leader
- Interviews with clinicians and staff
- Observations with clinicians and staff
- Interview with patients

Observation notes were recorded in a data collection form (see Appendix N) that focused on the five elements of the work system model: person, tasks, tools and technology, environment, and organization.

3.5.4.1. Interview with clinic manager. A guide was developed for the interview with the clinic manager (see Appendix H), including 14 questions about the history and current status of the clinic; patients in the clinic; how the clinic is organized; daily workflow in the clinic, use of health IT in the clinic and the impact of these applications on the clinic; usefulness and usability of the applications; facilitators and barriers to health IT implementation; and whether the implementation of health IT had provided opportunities for redesign of clinic workflows.

3.5.4.2. Interview with physician leader. The interview guide for the physician leader (see Appendix L) includes questions about the history and current status of health IT in the clinic; health IT support; future health IT plans; training for health IT; the impact of the applications on the clinic; security and privacy of health IT; the impact of the applications on patient satisfaction; and facilitators and barriers to health IT implementation.

3.5.4.3. Interviews with clinicians and staff. Interviews with clinicians and staff included questions about the health IT applications of interest that the interviewee was familiar with. During the interview, clinicians and staff were asked how each application affected their work, work environment, and workflow; the impact on communication; usability and usefulness of the health IT applications; the impact of each application on quality of care and on patient satisfaction; and facilitators and barriers to the use of health IT applications, including privacy and security issues. We also asked the interviewees how satisfied they were with the health IT applications discussed, on a scale from 1 (not satisfied at all) to 5 (very satisfied). See Appendix M for the interview guide.

3.5.4.4. Observations with clinicians and staff. Observations were focused on patient-reported information: how it is solicited and received from patients, and integrated into other existing health information systems (e.g., EHR); and when and how it is used by physicians,

other clinicians, and office staff. Researchers observed physicians, other clinicians, and office staff as they worked to elicit, integrate, and work with patient-reported information. Observations were focused on processes, bottlenecks, facilitators and barriers, workarounds, and points in the workflow when paper information supplements electronic information. During the observations, researchers asked explanatory questions of those being observed to ensure that the workflows were correctly understood, clarify how individuals share information and responsibilities, and understand variations from one individual to another. In practice, the discussion during the observation usually covered several of the questions in the interview guide; in these cases we considered the interview and observation to be conducted concurrently.

Detailed notes were recorded on the observation data collection sheet (see Appendix N) and typed up as soon as possible after the end of the observation.

3.5.4.5. Interview with patients. During patient interviews, questions were asked about use of the health IT application, usability and usefulness of the application, and how satisfied patients were with the application (see Appendix O).

3.5.5 Questionnaire for Web-Based Survey

A questionnaire was developed and administered as a Web-based survey to measure user satisfaction with health IT applications through which patients provide information electronically. The surveys were used to collect data regarding attitudes about and perceptions of the health IT workflows staff engage in related to patient-reported information, and the impact of health IT on workload, stress, and job satisfaction—because workflow can impact workload and job satisfaction, which have been shown to impact quality of care. The survey was also used to collect data on barriers and facilitators associated with capturing and using patient-reported information.

The survey consists of 85 questions in eight sections, although 12 questions were inappropriate for staff and therefore skipped when the survey was administered to staff (see Table 9). More details about the survey questions can be found in Appendix Q.

Table 9. Summary of the topics in the clinician and staff questionnaire

Section	Topic	Number of questions (clinician/staff)	Example
Section A	About your job	5	How long have you been in your current position?
Section B	About readiness for organizational change	4	After we make changes to improve quality, we evaluate their effectiveness.
Section C	About the clinic's patient portal	14/10	The patient portal makes processes more efficient.
Section D	About secure messaging	14/10	Overall, secure messaging saves me time.
Section E	About e-forms	14/10	E-forms reduce my workload.
Section F	Barriers to using health IT in your work	12	How much of a barrier is each of the following to beginning or expanding the use of computer technology in your main practice: Privacy or security concerns?
Section G	About your perceptions of work	15	How satisfied are you with the care you provide?
Section H	About you	7	What is the highest level of education you have completed?
Total	8 sections	85/73	

3.5.6 Post-Visit Followup Call Guide

After each site visit, researchers conducted an interview with the clinic manager and/or physician leader to review and receive feedback on workflow process maps for the clinic. The maps were sent out before the interview to give the clinic manager and physician leader time to review them thoroughly. The interview guide includes questions about whether the clinic processes are represented correctly in the maps and whether processes are missing (see Appendix S). After the interview, the workflow process maps were corrected, if necessary.

3.6 Data Analysis

In this study we aim to answer the following research questions:

1. How does the use of health IT to capture and use patient-reported information support or hinder the workflow from the viewpoints of clinicians, office staff, and patients?
2. How does the sociotechnical context influence workflow related to the capture and use of patient-reported information?
3. How do clinics redesign their workflows to incorporate the capture and use of patient-reported information?

To answer research question 1, we used interview and observation data to describe and represent the workflows related to health IT applications to capture and use patient-reported information for clinicians, clinic staff, and patients. Interview, observation, and survey data were then analyzed to describe the workflow facilitators and barriers from the viewpoints of clinicians, clinic staff, and patients.

To answer research question 2, the sociotechnical context is described using data from the pre-visit questionnaire, and interviews with the clinic manager and physician leader. The following analyses were conducted to evaluate the role of the sociotechnical context on workflow:

- Comparison of clinician and staff workflows related to patient-reported information across various clinics
- Comparison of patient workflows for reporting information, across various clinics
- Comparison of workflow facilitators and barriers of health IT applications to capture and use patient-reported information across various clinics

Data from the different sources are displayed in cross-case summary tables (see Appendixes T-U).

To answer research question 3, data collected with the pre-visit questionnaire, interviews with clinic managers and physician leaders, and the clinician and staff interviews and observations were analyzed to identify instances where the clinics redesigned their workflow to incorporate the use of patient-related information.

3.6.1 Analyzing Interview Data: Initial Coding and Creating a Node Structure

Interview and concurrent observation-interview data were uploaded into Dedoose®, a qualitative data analysis software. The research team read and discussed three of the clinician and staff interviews from the first clinic. We developed descriptors to attach to each interview or concurrent interview and observation (e.g., clinic, job title, and type of health IT application discussed) and an initial node structure. Creating a node structure is an iterative process. We

developed a preliminary list of nodes by selecting from nodes identified in previously conducted health IT research and adding nodes that were needed to answer our research questions. As data analysis progressed the initial node structure was refined several times. In our analyses, we refer to these nodes as dimensions. Table 10 contains the definition of each dimension for the analysis of facilitators and barriers to workflow. We use the term dimension because the same dimension can sometimes be perceived as a barrier and a facilitator to the workflow associated with a health IT application. Further, we distinguished between (1) workflow facilitators and barriers, and (2) facilitators and barriers to possible outcomes (i.e., satisfaction with technology, patient satisfaction, and perceived quality of care and patient safety). Because our analyses focus on workflow barriers and facilitators, we briefly present the findings related to outcomes in a single section.

Table 10. Definitions of dimensions used in coding facilitators and barriers to workflow

Dimensions	Definition as a barrier	Definition as a facilitator
Amount of work	The health IT application has increased workload and issues related to workload, such as an increase in amount of work, more time needed to finish tasks, and duplication of tasks.	The health IT application has decreased workload and issues related to workload, such as a decrease in amount of work, and less time needed to finish tasks.
Task complexity-simplicity	The health IT application has caused processes to become more complex. This includes having more actors involved in a task and having to complete more steps per task.	The health IT application has caused processes to become less complex, including having fewer actors involved in a task and having to complete fewer steps per task.
Inappropriate use	Clinicians, staff or patients use the health IT application in a way that the clinic did not intend it to be used.	Not applicable
Workaround	Not applicable	Clinicians, staff or patients develop workarounds to circumvent barriers related to use of the health IT application in order to get their work done.
Usability*	Problems related to the design of health IT applications affect effectiveness, efficiency and satisfaction of users.	Characteristics of the design of health IT applications support effectiveness, efficiency and satisfaction of users.
Communication and information flow	The health IT application has changed communication or information flow for the worse. Communication has become more difficult or information flow has changed for the worse. Includes communication with patients, clinicians or staff; frequency of communication; and quality of communication.	The health IT application has improved communication or information flow, including communication with clinicians, patients or staff; frequency of communication; and quality of communication.
Ambiguity-clarity	The health IT application has caused processes and tasks to become more ambiguous, including who will perform specific tasks and when but excluding communication.	The health IT application has caused processes and tasks to become clearer and less ambiguous, including who will perform specific tasks and when but excluding communication.
Organization of work	The health IT application has negatively impacted work processes and tasks, including the sequence of tasks, who does tasks and when, priority of tasks, and dependency of tasks on other tasks.	The health IT application has positively impacted work processes and tasks, including the sequence of tasks, who does tasks and when, priority of tasks or dependency of tasks on other tasks.
Satisfaction with IT application	The health IT application has had a negative impact on the user's satisfaction with health IT used in the clinic.'	The health IT application has positively affected the user's satisfaction with health IT used in the clinic.'
Patient satisfaction (Clinicians and staff only)	The health IT application has made patients less satisfied with the clinic or the care they receive.	The health IT application has made patients more satisfied with the clinic or the care they receive.
Quality of care and patient safety	The health IT application has negatively affected the quality of care and patient safety.	The health IT application has positively affected the quality of care and patient safety.

* Our definitions of usability barrier and facilitator are based on the ISO 9241 definition ("The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.").

Table 11 below summarizes the dimensions that were used to code facilitators and barriers for clinicians, staff, and patients. With some exceptions (e.g., inappropriate use for patients), we were able to use the same dimensions for all three types of research participants. Using the same dimensions allowed us to easily compare the facilitators and barriers across the types of interviewees. This table also shows which element of the SEIPS model is associated with each of the dimensions.

Table 11. Dimensions for coding the interview data for facilitators and barriers

Dimension	SEIPS model elements	Clinicians and staff		Patients	
		Barrier	Facilitator	Barrier	Facilitator
Amount of work	Task	X	X	X	X
Task complexity/simplicity	Task	X	X	X	X
Inappropriate use	Task and Tools/Technology	X	NA	NA	NA
Workaround	Tools/Technology	NA	X	NA	X
Usability	Tools/Technology	X	X	X	X
Communication and information flow	Organization and Task	X	X	X	X
Ambiguity/clarity	Organization and Task	X	X	X	X
Organization of work	Organization	X	X	X	X
Satisfaction with technology	Outcomes	X	X	X	X
Patient satisfaction	Outcomes	X	X	NA	NA
Quality of care and patient safety	Outcomes	X	X	X	X

NA=Not applicable.

We started by coding the interviews that described use of a patient portal to upload information. After we coded all the interviews on use of a patient portal, we used Dedoose© to create matrices of the facilitators and barriers for clinicians, staff, and patients. We analyzed the data by assessing whether facilitators and barriers related to each dimension were identified in each interview and/or observation. The goal of qualitative data analysis is to be able to categorize and compare facilitators and barriers. Therefore, we report the percentage of interviews in which facilitators and barriers for each dimension were identified. Note that the figures and tables in Sections 4.1.2, 4.2.2, and 4.3.2 describe facilitators and barriers at the interview level. Our analysis measures whether each interview or concurrent interview and observation contains information on any facilitators (or barriers) related to each dimension, not the number of facilitators (or barriers) described. Note also that we interviewed physician leaders, clinic managers, clinicians, staff, and patients. The physician leaders were coded as clinicians; the clinic managers were either coded as clinicians (if they were nurses) or as staff (if they did not have a clinical background).

3.6.2 Redesign of Workflow To Incorporate the Capture and Use of Patient-Reported Information

We also analyzed interview and observation data to answer the third research question: “How do clinics redesign their workflow to incorporate the capture and use of patient-reported information?” We define redesign as an intentional process, one that clinic staff undertake deliberately. The redesign process includes (1) reviewing data on use of the health IT application and/or examining the information provided by patients through the application and (2) making intentional changes to clinic workflows based on these data. Incidental workflow changes related to health IT, such as a decline in phone calls due to more patient communication being conducted through secure messaging, are instead analyzed as facilitators and barriers related to research question 1.

3.6.3 Analyzing Survey Data

Descriptive statistics were created for the individual clinics and the whole dataset. The survey data were used to answer research question 2. Chi-square-tests and t-tests were used to determine differences between the clinics.

4. Results

Patients used several methods to electronically provide information to their clinic and providers. Secure messaging was used in five of the six clinics studied. Two clinics used electronic forms (e-forms) and two clinics allowed patients to upload information through a patient portal into the electronic health record (EHR).

4.1 Secure Messaging

4.1.1 Descriptions of Health IT Application and Clinic Workflow

Of the five clinics using secure messaging, four (Clinics 1, 3, 5, and 6) used EHR systems from the same vendor, Epic Systems. Although there were a few minor differences between the patient portals of these clinics, secure messaging was nearly identical. For the patient, using this health information technology (IT) application is very similar to sending an email. It requires—

1. Logging into a patient portal.
2. Selecting “send a message.”
3. Selecting whom to send the message to.
4. Indicating that the sender has read a list of warnings (e.g., do not send a message about urgent health issues).
5. Entering free-text for a message subject.
6. Entering the text of the message.
7. Clicking “send.”

When a clinician or staff member sends a secure message responding to the patient, an email is sent to the patient’s nonsecure email account, alerting him or her. (See Figure 10 for a description of the patient process.)

On the clinic side, patient messages appear in a folder for secure messages within the “in-basket.” The in-basket also includes folders for prescription refill requests, test results, phone messages, documentation of a patient visit, and orders needing to be signed. The clinician opens the secure message by clicking on the folder and then clicking on the message. S/he is able to respond directly to the patient by secure message, route the message to another person, or open documentation for a phone call while attaching the secure message to the “phone encounter.”

The secure messaging system used by Clinic 2, Bizmatics Prognosis, is relatively simple to use. To send a message, the patient logs into the portal and selects “send a message.” The only possible recipient is the provider. The patient enters free text on the subject line and types in the message. Messages have a limit of 120 words, but patients work around this limit by sending more than one message. The physician receiving the message opens the EHR, clicks the tab at the top of the screen for “messages,” and clicks on a message to open it. She can respond to the patient by sending a reply or route the message to other clinic staff. If she marks a forwarded message as urgent, it will pop up on the screen of the recipient as well as being accessible through the messages tab in the EHR.

Table 12 summarizes the volume of messages in each clinic. The data were collected in interviews with the clinic manager, physician leader, clinicians, and staff. In addition, some of the clinics ran an EHR report to help us estimate the volume of secure messages in their clinic. Results in Table 12 show that Clinics 1 and 2 have a relatively large volume of secure messages per provider. In contrast, secure messaging volume is lower in Clinics 3 and 5 and very low in Clinic 6.

Table 12. Secure messaging per provider per clinic

	Clinic 1	Clinic 2	Clinic 3	Clinic 5	Clinic 6
# physicians	7 (10 full-time equivalent [FTE] incl. physician assistants [PAs])	1	3	7 (6 FTE)	8 (5 FTE, incl. PA and nurse practitioner [NP])
Patient Panel	14,000	4,500	2,500	7,188	5,000
Secure messages received per provider per day	10–12	30–40 (including secure messages and email)	4–6	4–6	0–1

4.1.1.1. Clinic 1 workflow. Figure 2 shows a general workflow process map for Clinic 1. When the clinic receives a secure message, it is stored in a shared in-basket for the care team, which is accessed by nurses and medical assistants (MAs). Care teams in this clinic are composed of one or more physicians, one triage nurse (registered nurse [RN]), one or more roomers (licensed practical nurses [LPNs] or MAs), and sometimes one or more PAs. The triage nurse is usually the first to open a secure message, checking whether a patient has sent a message requiring an urgent response. Such urgent messages are rarely received, but if she receives one, the triage nurse calls the patient immediately. For non-urgent messages, the nurse has three choices:

1. She may close the message to address later. The triage nurse also addresses telephone calls and phone messages, and secure messages are considered to be lower priority than phone calls from patients. Messages that have been reviewed and closed remain in the in-basket until they are addressed.
2. She may route the message to a provider if provider input is needed. Sometimes she does research in the patient medical record first and attaches notes for the provider.
3. If time permits, the triage nurse may address a message that does not require provider input, either by sending a secure message in reply or by calling the patient.

LPNs and MAs are expected to open secure messages in the in-basket and check if they are able to address the message. Messages that LPNs and MAs could address are largely administrative and include, for example:

- a. checking whether a patient has received a vaccination,
- b. processing an uncomplicated medication refill, or
- c. scheduling an appointment.

Messages requiring RN licensure are left in the in-basket until an RN has time to address it. This clinic has an unwritten rule that all secure messages should be addressed within 48 hours of being received.

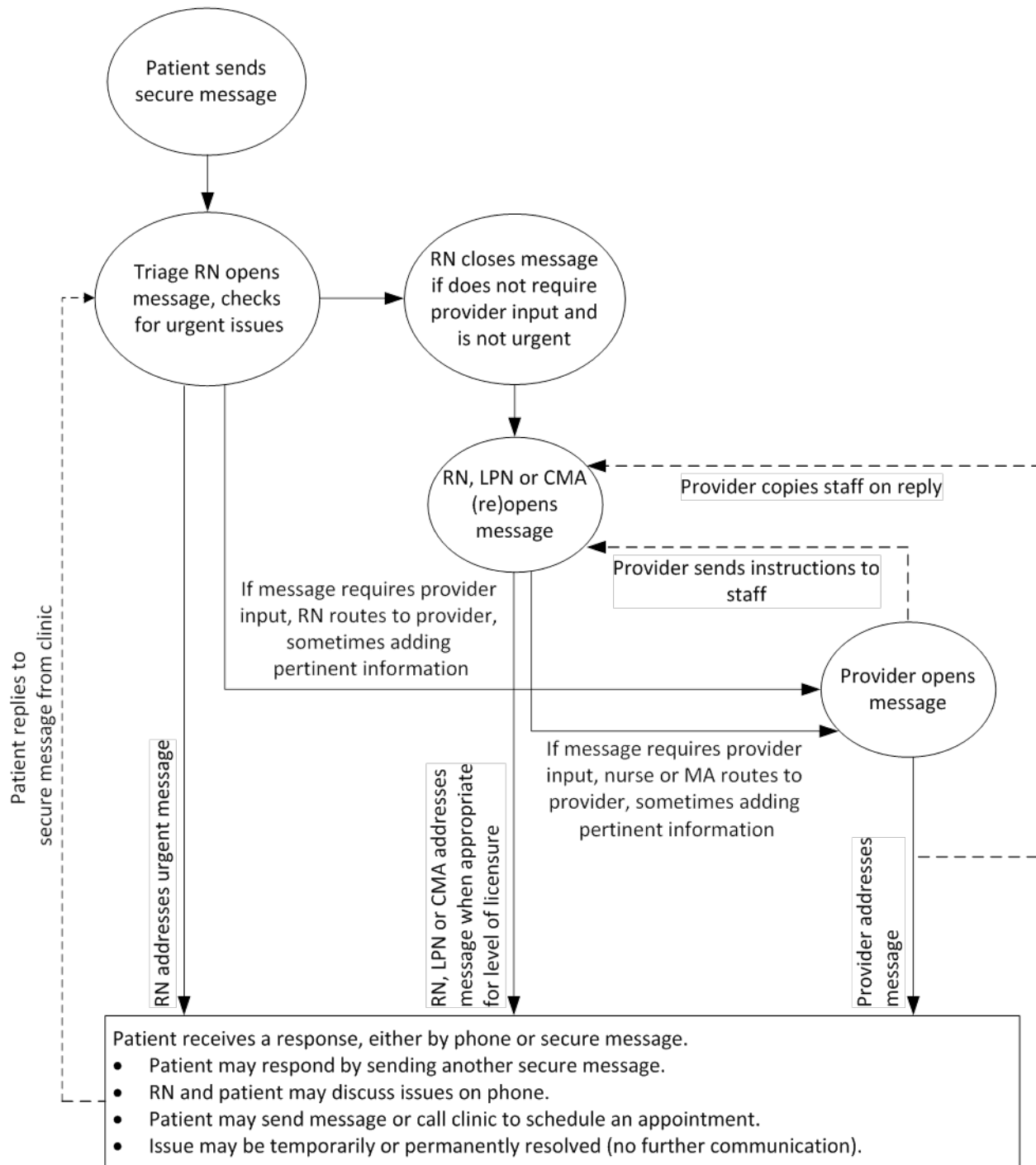
Many messages require review and response by a provider. Providers generally open messages between appointments and at the end of the day. A provider may address a message by:

- (1) replying to the patient,
- (2) routing the message to the care team in-basket with instructions for the nurse or MA on how to address it, or

(3) replying to the patient and cc'ing the nurse giving her instructions (e.g., follow up with this patient in three days if you do not hear from her).

If a secure message sent to a patient is not read within a specific number of days, the care team will receive an alert to let them know. In this situation, the nurse or MA will review the message for urgency. If needed, the nurse or MA will call the patient. If the message is non-urgent, such as normal lab results, the LPN or MA will send the patient a letter.

Figure 2. Secure messaging workflow process map for Clinic 1

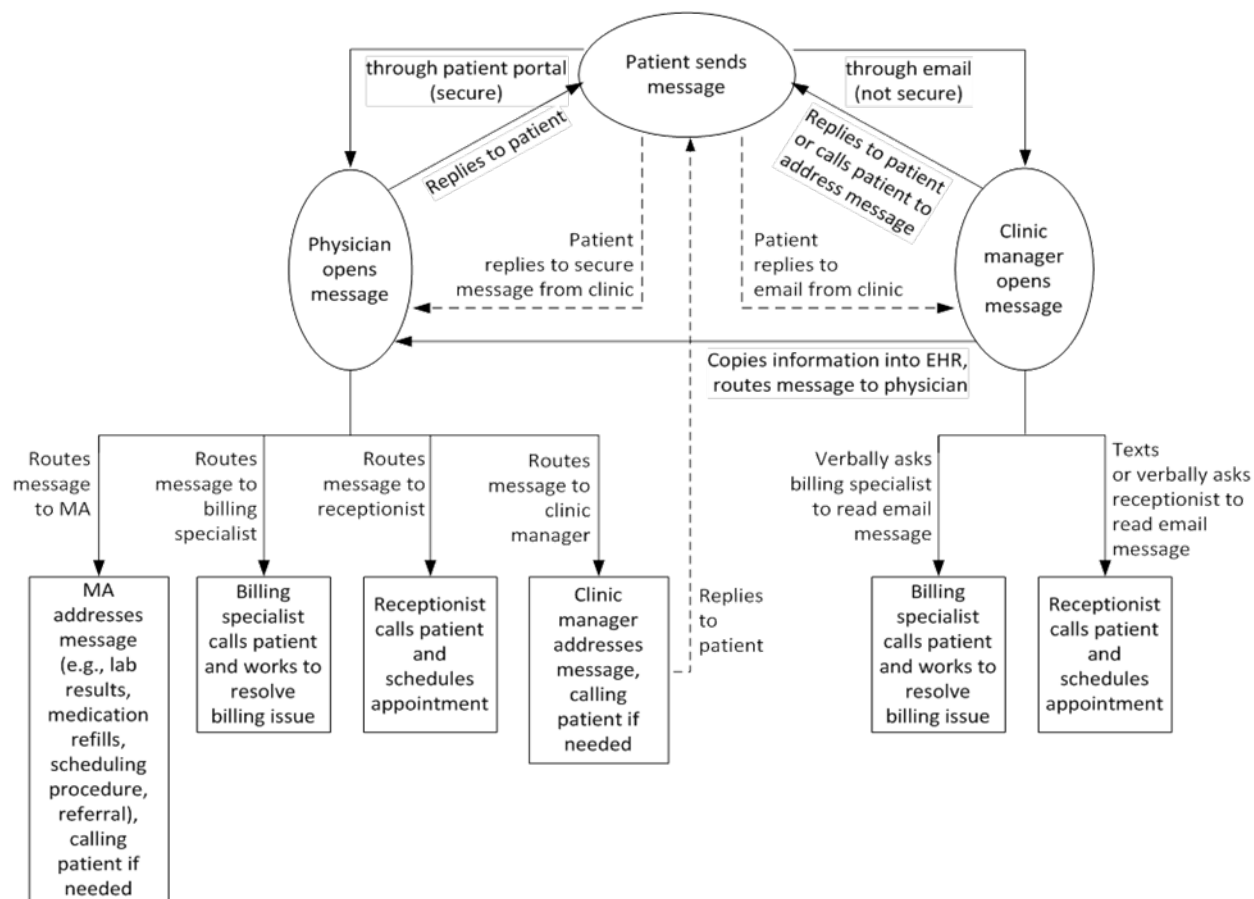


Within the process described in Figure 2, the specific management of secure messages varies by care team and provider. Each care team has one triage nurse who has learned the preferences of the providers within her care team. Some providers prefer to address most secure messages themselves, so the triage nurse addresses only a small subset of messages and routes the other messages to the provider. One clinic provider prefers to not address secure messages at all, and asks the triage nurse to call each patient who sends a message and ask the patient to schedule an appointment. Another provider does not typically respond to patients directly, but instead sends instructions to his staff on how to address the message, and the staff sends a reply to the patient or calls the patient. One provider prefers to respond to messages from familiar patients, but would rather have his staff handle as many messages as possible for patients he does not know well.

Difficulties may arise when a triage nurse is out of the office and is replaced by a “float” nurse who is not familiar with the providers’ preferences. Also, nurses and MAs with available time are encouraged to work on the in-baskets of other care teams – or even the care teams in another clinic—which can lead to the providers’ preferences not being followed.

4.1.1.2. Clinic 2 workflow. This clinic is staffed by one physician provider, supported by an MA, clinic manager, receptionist and part-time billing specialist. Clinic patients use secure messaging relatively heavily, and the clinic receives 15–20 secure messages per day. Figure 3 shows the process for addressing messages. As the only clinician, the provider triages all secure messages sent to the clinic, and either responds to the patient or routes the message to one of the other clinic staff. All messages related to clinical issues are addressed by the provider or MA. Messages related to scheduling are routed to the receptionist, and those related to billing are addressed by the billing specialist. All other messages are addressed by the clinic manager. Aside from the provider, only the clinic manager responds to patients using secure messaging. All other staff contact the patient by telephone to address the issues raised in the secure message.

Figure 3. Secure messaging workflow process map for Clinic 2

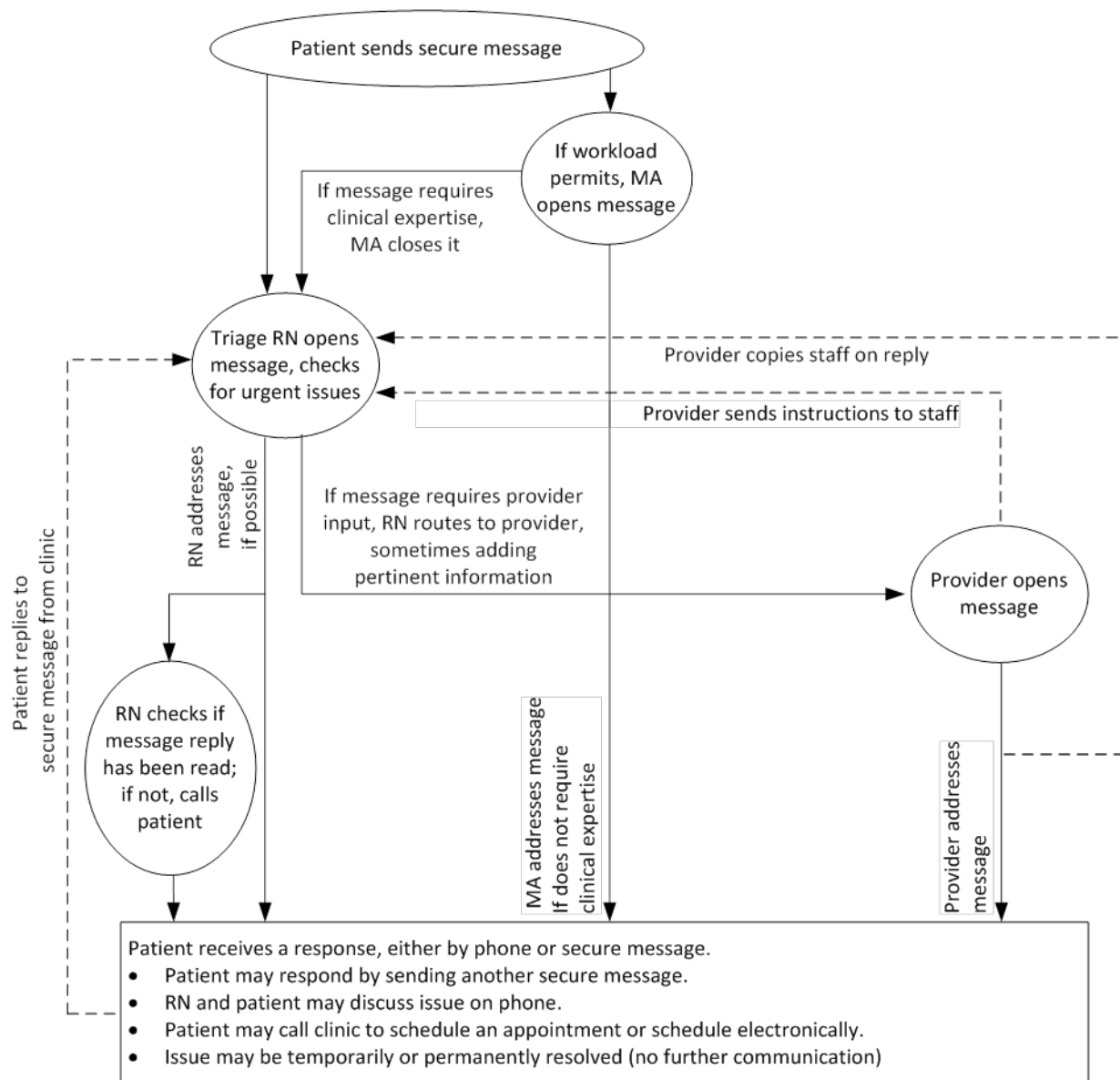


In addition to secure messaging, this clinic also frequently receives another 15–20 patient emails per day sent to a Yahoo (nonsecure) email address that can be accessed through a link on the clinic Web site. The clinic discourages patients from sharing protected health information (PHI) through the nonsecure email but does not require that patients use secure messaging. The clinic manager checks the Yahoo email account throughout the day and sends email responses to patients. The clinic manager copies any patient information sent by email and pastes it into the EHR, then uses secure messaging to route the message to the provider if clinical issues require his attention. To share an email with other clinic staff, the clinic manager verbally asks the billing specialist or receptionist to access the clinic’s email account and read the message. If she is working at home, the clinic manager sometimes sends the receptionist a text asking her to check the Yahoo email and schedule a patient appointment.

4.1.1.3. Clinic 3 Workflow. Clinic 3 has two care teams, each comprising a triage RN, an MA, and a physician. The care teams share responsibility for patients of a third provider, who is relatively new and still building a patient panel. The entire clinic shares an in-basket in the secure messaging system, but each staff member normally opens messages only for the provider in his or her care team. The process for handling secure messages (see Figure 4) varies slightly between the two care teams. The MA in one care team sometimes opens secure messages, if his workload permits, and determines whether each message requires clinical expertise. If a message does not require clinical expertise, he will address it. The MA in the other care team leaves all

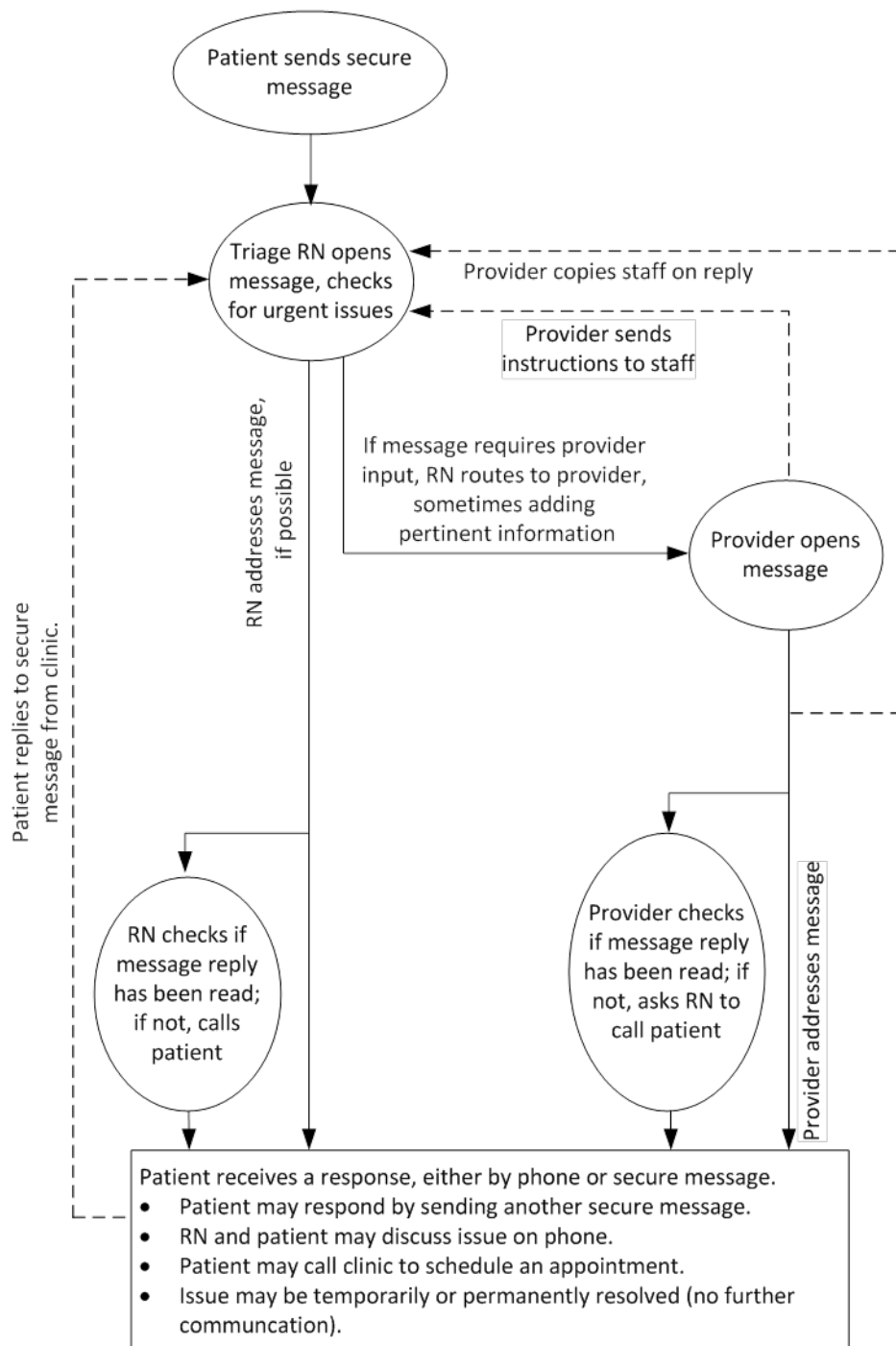
secure messages to be opened by the RN. In both care teams, the RN is often the first to open a message and check for urgent symptoms that would require a call to the patient. Then she responds to the message if she can, either by phone or by sending another secure message in reply. If the message requires the input of a provider, she routes the message to the provider, sometimes after doing research in the patient medical record and adding notes to the message. The provider sends the patient a reply, routing the message back to the RN with instructions on how to address it or directly replying to the patient while copying the RN with instructions. The staff of this clinic are aware of the functionality that could alert them if a message is not read by the patient, but the RNs prefer to check whether each message has been read. The volume of messages is relatively light in this clinic (four to six messages to each provider per day), and they aim to address all messages within 24 hours. One RN calls the patient if the secure message reply to the patient is not read within 4 hours.

Figure 4. Secure messaging workflow process map for Clinic 3



4.1.1.4. Clinic 5 Workflow. Clinic 5 is medium-sized, with seven physicians divided into three care teams. Each care team includes two to three physicians, two to three RNs, and one LPN or MA. The general process for responding to messages (described in Figure 5) is almost the same as for Clinic 3, except that the MAs do not work with secure messages and in some cases the providers also check whether their messages have been received by patients. If the patient has not read the message, the provider would ask the RN to call the patient.

Figure 5. Secure messaging workflow process map for Clinic 5

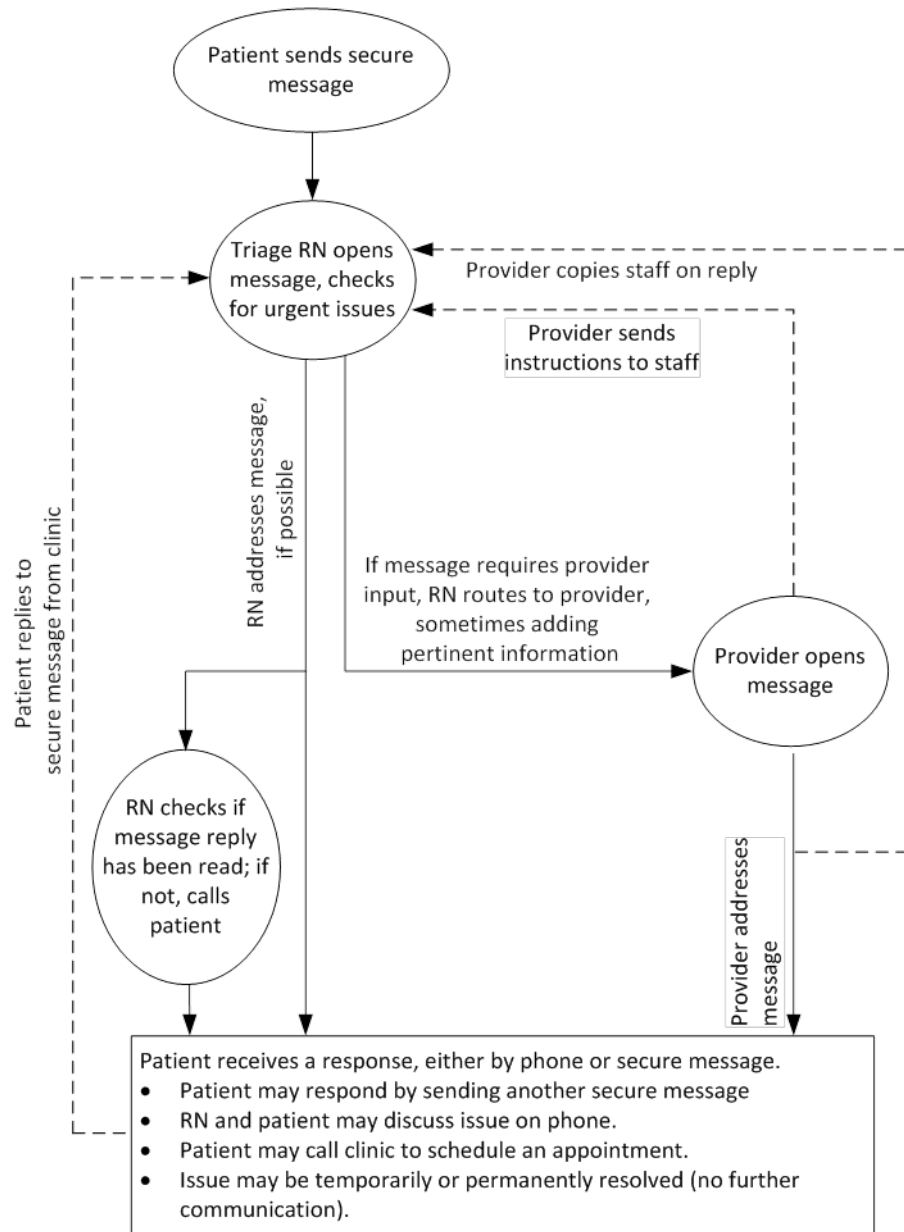


As in Clinic 1, the detailed process for addressing secure messages varies by provider in Clinic 5. Some providers prefer to address almost all messages themselves. In contrast, the nurses in one care team know that a provider will not respond to secure messages in a timely way; instead of routing messages to him, they catch him between appointments, ask how they should address the message, and handle the message themselves.

4.1.1.5. Clinic 6 workflow. Clinic 6 has a relatively low volume of secure messages—an average of less than one message received per provider each day. In this clinic triage RNs are not assigned to care teams. Providers are paired with LPNs or MAs to create care teams, while the triage RNs address phone messages, secure messages, and other tasks requested by providers. The workflow process map for handling secure messages is shown in Figure 6 and is very similar to the workflow process maps of Clinics 3 and 5. The differences are that unlike in Clinic 3, the LPNs and MAs do not address secure messages and, unlike in Clinic 5, none of the providers reported checking to ensure that patients read their secure messages.

The detailed process varies for each triage RN, based on the preferences of the RN. One of the triage RNs focuses on telephone messages, leaving the secure messages for the other triage RNs to address. Another RN is careful to check that all messages are read by patients, leaving the messages in her in-basket until she sees that the patient has read the message. If the message remains unread after several days, she will call the patient to ensure that the patient has received the information in the secure message. Also, this RN nearly always does research before routing a secure message to a provider, while another RN rarely does research in the EHR before forwarding a message to a provider.

Figure 6. Secure messaging workflow process map for Clinic 6



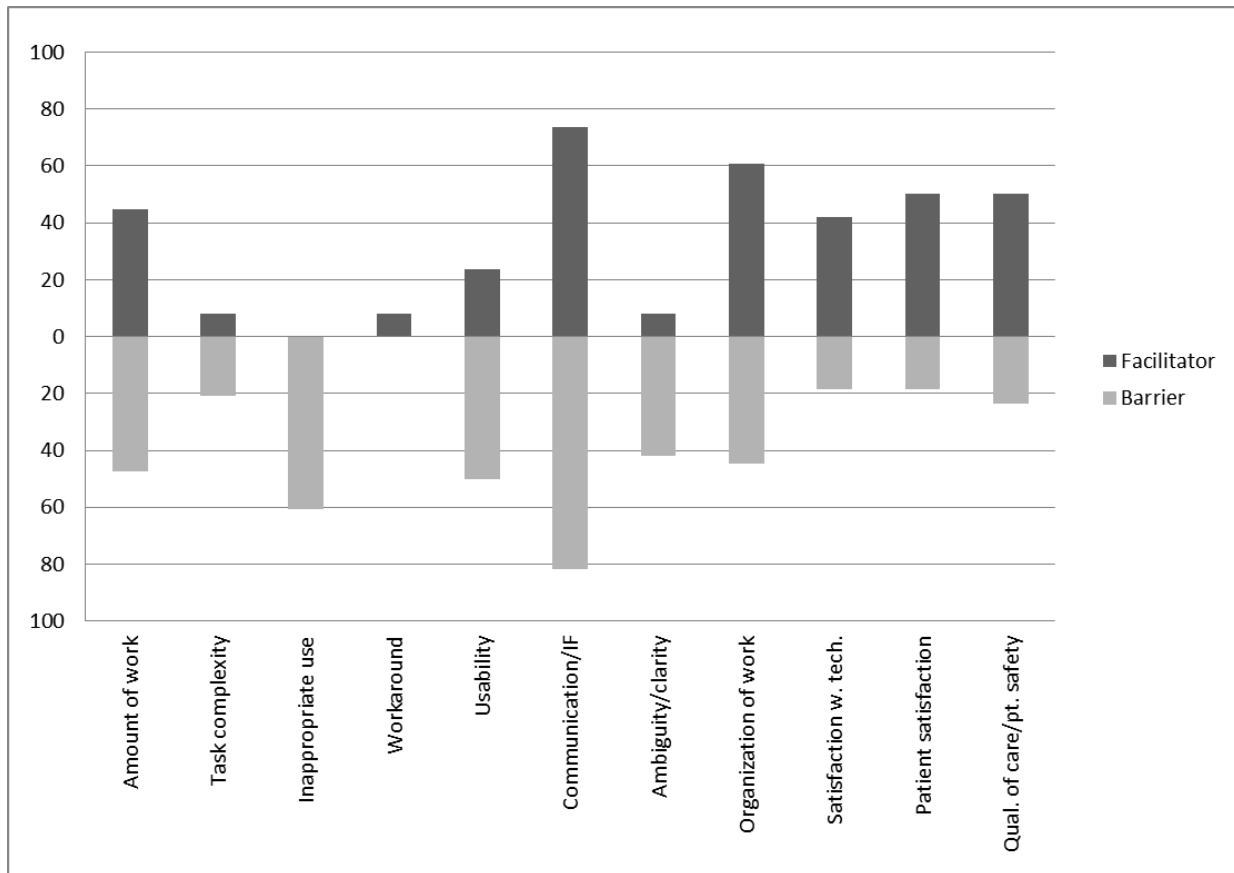
4.1.2 Research Question 1: Facilitators and Barriers to the Use of Secure Messaging

The first research question for this project asks “How does the use of health IT to capture and use patient-reported information support or hinder the workflow from the viewpoints of clinicians, office staff, and patients?” To answer this question, we present results of a qualitative analysis of facilitators and barriers to use of secure messaging. We analyzed the data for clinicians, staff and patients separately but using the same dimensions of facilitators and barriers, with a few exceptions (see Section 3.6.1). For each group we describe the results for the most common dimensions of facilitators and barriers.

4.1.2.1. Facilitators and barriers to the use of secure messaging identified by clinicians.

We analyzed the data from 38 clinician interviews or concurrent interviews and observations. Specifically, we interviewed 18 physicians (including three physician leaders), two PAs, one NP, 15 RNs (including one clinic manager), and two LPNs. Note that we excluded interview data for one RN clinic manager because she did not use secure messaging to communicate with patients. Figure 7 shows the percentage of clinicians who identified facilitators and barriers related to each dimension. (See Section 3.6.1 for dimension definitions.)

Figure 7. Facilitators and barriers to the use of secure messaging identified in clinician interviews (N=38)



Overall, clinicians identified fewer facilitators of secure messaging workflow (an average of 3.7 dimensions per interview) than barriers (an average of 4.1). The dimensions in which facilitators were most often identified by clinicians were communication, the organization of work, patient satisfaction, the quality of care and patient safety, the amount of work, and satisfaction with the health IT application. Dimensions with barriers most often identified by clinicians were communication, inappropriate use of the application, usability, the amount of work, the organization of work and ambiguity. Table 13 contains the number of clinicians who identified facilitators or barriers related to each dimension.

Table 13. Facilitators and barriers to the use of secure messaging identified in clinician interviews (N=38)

Dimension	Facilitator	Barrier
Amount of work	17	18
Task complexity/simplicity	3	8
Inappropriate use	NA	23
Workaround	3	NA
Usability	9	19
Communication/information flow	28	31
Ambiguity/clarity	3	16
Organization of work	23	17
Satisfaction with technology	16	7
Patient satisfaction	19	7
Quality of care/patient safety	19	9
Mean dimensions per interview (Standard Deviation)	3.7 (2.06)	4.1 (2.04)

4.1.2.1.1. Communication and information flow. Most clinicians mentioned facilitators related to communication. Several clinicians stated that secure messaging improved workflow by opening another line of communication for patients to reach the clinic.

I think it has very much improved the capability of the patients to reach us. ... Prior to MyChart [the clinic's patient portal through which secure messages are sent], basically, the only way they could reach us was with a phone call or an office visit or a letter. So now they can email us. So yeah, I think it has greatly improved the access of the patient to the physicians and to the nursing staff. (Clinic 5 Physician Leader)

Clinicians also described communication through secure messaging as being useful for patients with chronic illnesses who wish to give frequent updates on their progress. Several clinicians believe that secure messaging allows patients to develop a closer relationship with providers and the clinic.

It allows the patients to feel like they can interact with their provider at any given time. The [patient] who emails me a couple times a week, it's often [at] 2:00 in the morning. ... I think that's a very reassuring thing. She knows I'm seeing it. She's communicating to me. (Clinic 6 NP)

Clinicians also mentioned that it is easier for patients to send a message than to call the clinic and "play phone tag." Patients are therefore more likely to share information that is useful for clinicians and to be engaged in their care.

I'm glad if they can only remember to send me their blood pressures at 11:00 at night. Send them, and I'll see them in the morning. ... [It] does offer some advantages, because it's another way to get people into the office, or at least into the health care system, that might not have otherwise actively engaged. I think it's a helpful way to get people to do followup. They'd much rather send me their blood pressures or report back on symptoms than physically come here and pay a co-pay. (Clinic 1 Physician)

Also, several clinicians stated that some patients are able to communicate questions in a message that they are embarrassed to talk about with reception staff or ask in person.

Turning to barriers, several clinicians mentioned issues related to the quality of communication. Nurses and providers both stated that a patient's tone of voice can provide useful information that is not conveyed through messaging.

I think that there is something to verbal communication versus written or electronic. You can hear things in the patient's voice. Or you can tell if they were to write about symptoms they were having, it may be different when they type it versus when you talk to them. ... [You] might be able to hear that they are short of breath, those types of things. So I think you could easily be missing information through electronic messaging. (Clinic 5 RN)

Patient messages can also be unclear. Triage nurses find it easier to handle ambiguous communication over the phone because they can ask questions until they have the information they need. Clinicians are also concerned that they could miss important patient information while communicating with patients through secure messaging.

The issue, of course, is did I interpret things correctly? Did I get it right, or did I miss something important and pass it off as minor? Again, I think that human interaction makes that less likely than the computer interaction. (Clinic 5 Physician)

Another barrier arises when patients write very long messages, which can make it difficult for clinicians to find the information that they need.

[Patients sometimes write] three to four pages ... about their complaints. And the problem, of course, is that you have to read it all, because otherwise you might miss something, right? ... [You] never know where the kernel of importance is, and so you're stuck reading the whole darn thing. (Clinic 5 Physician)

Several clinicians said that communication is sometimes interrupted because patients stop checking secure messages. This is a particular concern when a message is sent to inform the patient that a test has been ordered or an appointment has been scheduled. Most clinicians avoid this issue by always having staff call the patient to share time-sensitive information. A related issue arose in Clinic 5 when several providers tried to communicate with "active users" (defined by the vendor as having requested an account and logged in once) of the clinic's patient portal primarily through secure messaging. The providers sent the patients secure messages about ordered tests, scheduled appointments, and medication changes, but many patients did not check messages in the portal. The providers expressed frustration "because there's not really a good way to [note] in the system that this patient is not going to read their" messages (Clinic 5 Physician), so the providers reverted to communicating time-sensitive information by phone to all patients.

4.1.2.1.2. Organization of work. Many clinicians described facilitators or barriers related to the organization of work. One facilitator for providers is that nursing staff in most clinics try to address as many messages as possible without involving the provider. Providers also have flexibility to answer messages directly or delegate that task to nursing staff.

With the MyChart encounter you can reply to the patient, or you can ... just [add documentation telling] the nurse, compose a MyChart message that basically says this, and because it takes me extra time to word it nicely [that saves me time]. And I know our nurses try to reply to as many of the MyChart messages as they can. So sometimes I'll get a message that's gone back and forth a few times, and now they just need the order for the thing, and that's helpful too, if they can do that. (Clinic 5 Physician)

Similarly, the single provider in Clinic 2 deliberately decided not to stop his patients from using nonsecure email instead of secure messaging. Because the clinic manager addresses many of the nonsecure emails received by the clinic, his workload would increase if patients were discouraged from emailing the clinic and sent secure messages instead.

[In] some ways, I really want [my patients] to all use a secure portal system, but in some ways I don't. And this is somewhat selfish, because [the clinic manager] gets the email. ... She responds to a lot of [them] ... and she'll just put in the chart an FYI [to] just let me know. [A] lot of times I'll see that [the notes about the email] were there, but I ... don't even look at them. ... I let her do those. (Clinic 2 Physician)

Another facilitator clinicians mentioned is that patients “transcribe” their own concerns by typing in the message themselves, saving staff time.

The asynchronous nature of communication through secure messaging was a facilitator several providers mentioned, because they can address messages as they have time. Nurses also feel this is a facilitator, because the asynchronous communication allows them to research the issues raised in a secure message without feeling time pressure.

[I]t gives us more of a chance—without [the patient] sitting on the other end with that dead air—to pull up more records or to get their paper chart. ... That patient sitting on the phone, they don't want to call back. ... [They] want that answer more immediate[ly]. Whereas, [using] MyChart I can do all that stuff without them knowing that I'm doing it, because they're not just waiting. ... [I can] talk to a provider ... without interrupting anybody's workflow. (Clinic 5 RN)

Another facilitator for one provider is the use of secure messaging as a reminder of topics to discuss during the office visit, particularly when family members are communicating information that they do not want to share verbally in front of the patient during the office visit. The provider sends a message to himself in the EHR as a reminder to review this pertinent information just before the office visit.

[Before an office visit] very frequently, I'll get a MyChart [message] from a family member about Mom and her dementia, and this is what we were worried about. ... So I'll send myself an in-basket for the day I'm going to see Mom and say “see MyChart” to remind myself. [That way] you know what you're going into, and you don't forget stuff. (Clinic 1 Physician)

Several clinicians reported that using secure messaging instead of an office visit is a facilitator. For example, providers described having patients send secure messages to “check in” after an appointment rather than requiring a followup office visit.

I think the blood pressure example is a good one. ... I saw you in clinic. We made this change. [Send me a secure message] in two weeks, and let me know how it's going. Or, you know, some other symptom, knee pain. Okay. This is our first step. This is what I think is going on. But if you're not getting better, it could be this or this, and these are our next steps. [Send me a message] or call my nurse in two weeks. And I sometimes even write down, these are the three questions I want you to answer for me when you call me back or [write] me back. And then we'll decide on next steps and management based on that. So again, it's another example of where it replaces an office visit, right? Rather than physically seeing you in a week, if I can safely do it by [secure messaging, I] will. (Clinic 1 Physician)

Barriers related to the organization of work included providers who wished that nurses would address a larger share of messages or do more research before routing a message to a provider. One provider in Clinic 1 said that, due to turnover in his staff, he rarely has nurses who address messages appropriately and provide enough information when routing a message to him.

PHYSICIAN: [I have to address messages that are] junk, nonstructured, inappropriately pushed to [me]. Everybody has different priorities for it. I mean, some [nursing staff] just want to get it off their plate and send it to the doc and we're done. But being the doc, it's frustrating. ... The default [for nurses is to send it to the physician] if it's taking too much time or it's, I just don't want to do it.

INTERVIEWER: But you're able to train your staff more?

PHYSICIAN: When they don't leave. (Clinic 1 Physician)

4.1.2.1.3. Ambiguity or clarity. Nurses, particularly triage RNs, reported that use of secure messaging created ambiguity in clinic workflows. For example, the use of shared in-baskets creates ambiguity about whether messages have been addressed and who is working on them.

[I wish] the MyChart system ... was a little more straightforward, just like the telephone calls. ... When you go to the in-basket and you look at MyChart, this is confusing to me. Like how many of these people have been taken care of and how many haven't been taken care of, and why have they been read but not addressed? When they're bolded, it means that they haven't been read. If you're going to read it and not take care of it, then you should put it back to new. And I don't know why there's so many in here. (Clinic 1 RN)

Another issue is that providers have different preferences for how messages should be addressed. For example, some providers like to read patient updates themselves and respond briefly, while others do not want patient updates routed to them unless the patient needs advice that the nurse cannot provide. Nurses who work regularly with the same provider come to learn the provider's preferences, but for nurses who are new to the clinic or who are filling in for another nurse, this variation leaves them unsure how to address specific types of messages.

Ambiguity can also be created when a patient request is communicated to the clinic in multiple ways. For example, a patient may submit a refill request through a patient portal, call the clinic, and call their pharmacy, prompting the pharmacy to fax a refill request. In this situation, several triage nurses may be working on the request simultaneously, and there is ambiguity about who should take the next steps to resolve the request. In the six clinics studied, nurses have made changes in workflows to identify and resolve situations where the patient sends multiple versions of the same request.

Usually, if we see [a patient request that may be a duplicate], ... when we click on it, it will say last accessed by, so you can see which nurse might have been maybe dealing with it, or else we'll just ask each other if we see a phone encounter and a MyChart message sitting in their chart from the same day. You know, we'll either read through them or just [ask], can one of these be closed, do you want me to deal with it, or do you have it? (Clinic 5 RN)

Similarly, ambiguity arises when patients send two or more messages on the same topic. When replying, clinicians must cut and paste the information into a single message to minimize the chance of confusion about who should be addressing the patient issue or duplication of work through having two clinicians working on the patient issue at the same time.

Some of [the messages] will say one of two. Oops, forgot to tell you my pharmacy ... So then on that one, I'll just copy and paste it on the first one, and then on the second one, I'll document see other MyChart message dated today's date, and then I'll "done" that one so at least I'm not trying to figure out which one I'm documenting what. And then it makes [the physician] a little less crazy, because he's not dealing with two from the same person. (Clinic 1 LPN)

Nurses also described ambiguity about the status of messages. In two clinics, triage nurses were concerned about whether patients had read secure messages and whether providers had reviewed and addressed secure messages that were routed to them. In response, nurses store all secure messages in their in-basket until they are certain that the message has been fully addressed.

We keep [the secure message] in there until we can see that it's been dealt with, which is very difficult to know sometimes. Because sometimes the doctor may have viewed it as an FYI, but maybe the patient was expecting a response. So they sometimes can linger in there while we're trying to figure out if anything needs to be done with it. (Clinic 6 RN)

In other cases the provider did additional work to prevent the ambiguity just described, sending one message to the patient and another to nurses to keep them informed.

4.1.2.1.4. Inappropriate use of health IT application. In every clinic studied, clinicians gave examples of patients who used secure messaging "inappropriately." Both providers and nurses said that secure messaging was useful if patients used it correctly, and most patients do. However, a minority of patients used messaging in inappropriate ways. For example, many clinicians had received a message about an urgent medical issue, such as a patient reporting symptoms of a heart attack. Urgent messages are particularly problematic if they are sent at a time when the clinic is closed. None of the clinics studied have staff checking for urgent messages after hours. Triage nurses were also concerned when a patient sent a message describing an urgent medical issue but could not immediately be reached by phone.

In Clinic 2, secure messages have a word limit, but some patients write multiple messages to avoid the limit.

[M]y patient portal is set up that you can type up to, I think, 120 words. After 120 words, you're done. So you would think that would be the clue that that's how long my message should be. However, then part two comes and part three until they're finished. So that is a little frustrating, because some patients learn that, they take advantage. They just write a whole book. (Clinic 2 Physician)

Also, some patients write too many secure messages in a short period of time, making it more difficult for the nurse to address the patient's concerns: "Patients ... overuse [secure messaging] to the point where [they]'re actually impeding my ability to help [them] because [they]'re messaging me so much" (Clinic 5 RN).

Another typical barrier is when patients write messages with inappropriate content, such as sharing information about nonclinical topics or asking questions that are not related to the patient's care. Another type of inappropriate content is when patients write secure messages to vent or complain. In one extreme case, a clinic had to "let a patient go" because of the number of inappropriate secure messages he sent.

[One patient's emails contained] not only complaining about his own physical health, but also he would be blasting doctors and criticizing and was negative, and it was just totally, totally inappropriate. And so we had to curtail that. That's the only time that I've known somebody to really abuse the MyChart. (Clinic 3 RN)

Several clinicians described patients who try to use secure messaging in lieu of an office visit, to save time or the cost of co-pays. In many cases, clinicians must convince the patient that the needed care cannot be provided through secure messaging.

RN: I think the biggest problem with kind of going back and forth is when people want, slash, need antibiotics, but they don't want to come into the clinic.

INTERVIEWER: Because they're trying to avoid the co-pay?

RN: Or they're [saying] last year I had the same thing. Well, great. Sorry, but you still need to see your doctor. (Clinic 5 RN)

In addition, several clinicians described a barrier that arose when a patient wrote a secure message from his or her own account about the health of a family member. The information is automatically saved in the sender's electronic medical record and must be manually copied into the family member's medical record. Issues with patient privacy and HIPAA can also arise when secure messages are written by someone other than the patient, for example when the patient shares his patient portal login with his wife and she sends messages on his behalf. In some cases, the wife will sign her own name; in others the clinician may not be aware that the wife is writing the messages. One provider pointed out that it can be difficult to protect patient privacy in this situation: "Where it gets a little bit sticky is when the patient starts letting a family member use their MyChart to send me questions, and I don't have the appropriate documentation to say that I can answer that" (Clinic 1 Physician).

4.1.2.1.5. Amount of work. Many clinicians described both facilitators and barriers related to the amount of work, indicating that secure messaging had both positive and negative effects on their workload. Nurses stated that secure messaging saves them time by allowing them to quickly address simple questions and process medication refills. It also saves nurses time because they do not have to type up information about a patient call. More than one triage RN stated that responding to a secure message is more efficient than phone communication because they do not have to play phone tag.

[Secure messaging is] a nice, easy way for me to let [a patient] know something, and I won't have to play phone tag with [them]... [That's] kind of a relief for a triage nurse, because phone tag is frustrating for both of us and time consuming. (Clinic 5 RN)

Providers also mentioned that secure messaging improves the clinic's overall efficiency, not because fewer messages are received but because some messages have been "shifted ... to quicker, efficient messaging [instead of] the callback and the delay" (Clinic 1 Physician).

For complicated issues, several nurses said they would rather read a long update about a patient's status than listen to a long patient phone call where the patient shares the same information. Several providers mentioned that they believed secure messaging saves time for the nurses by reducing the number of phone calls received by the clinic. One RN described how secure messaging allows her to multitask.

We can just address [a secure message] without ... being caught on the phone. Or if we are on the phone and taking notes, we can maybe answer a message at the same time and get more than one thing done. If it's a prescription refill, you know, I'm just kind of actively listening to a patient, and then we can get a couple things done at one time instead of single tasks. (Clinic 5 RN).

A provider described how receiving patient updates through secure messaging allows him to be more efficient in the exam room, because he has information about health concerns before the appointment and can think ahead about how to address them.

That happened just last week with a child with ADD, and the mother sent me a copy of an email that she got from school. ... So I had a chance to pre-review that and know [the issues] when he came in. So I guess we're having some troubles and, do you know about what time of day this teacher interacts with him? It was helpful to get right down to the issue. (Clinic 3 Physician)

Providers also felt that responding to a secure message is less work and less time-consuming than a patient phone call would have been, in part because it allows them to control the length of the encounter.

Several clinicians stated that secure messaging reduces the number of office visits by allowing patients to address issues without coming in to the clinic. Also, many clinicians said that if a patient had not sent a secure message, they would have contacted the clinic in another way, for example by phone. Other clinicians disagreed, stating that the ease of sending secure messages means that patients are contacting the clinic more frequently. They feel that this additional contact is increasing their workload.

I think people are much more free about sitting down and emailing something than they would be sitting down to call. ... It's just another portal of entry, but I think it does overall increase the number of entries that happen, because I think there is ... this is a pure guess, but I would bet that probably a third of what I get on MyChart, people wouldn't have sent if they had had to call for it. ... [They] would have waited to talk to me about it, or they just wouldn't have called at all. (Clinic 1 Physician)

Clinicians reported that the exchange of multiple secure messages with patients increases their workload. Patients expect to go back and forth exchanging secure messages to thoroughly discuss an issue that could have been addressed in a "30-second phone call." Clinicians find this to be an inefficient and time-consuming way to communicate.

Some providers mentioned that secure messaging can shift the workload from the triage RNs, who address most phone calls, to the providers themselves because they typically reply directly to messages from patients.

It does add a lot of work, and it adds a lot of time to answer. Because if I'm answering to my nurse, I can say, you know, lipid six weeks, use my abbreviations, and be done with it. If I'm answering to a patient, you've got to type it all out in complete sentences. You've got to make sure it's spelled right. Sometimes when it just comes directly out of my head, the grammar may not be perfect, and you've got to go back and fix it. Or you're doing three things at once while you're trying to type, and you've got to go back and make sure that it makes sense or that you completed a thought. I guess that's my biggest issue is that it made sense in my head as I was writing it, but when you go back and read it you're like, oh, yeah, they're not going to understand that, and you need to type a little more. ... I'm not saying it's a bad thing to be polite. I'm happy to do it. But it takes time to be cordial and, you know, congenial and all of that. It's just more words. (Clinic 1 Physician)

Many providers described the need to work after the end of the clinic day, responding to secure messages and completing documentation related to messages.

[Secure messaging] can make us more efficient through the course of the day, but yet, you know, it can also make our work day longer, making sure that we address the in-basket and the documentation required with in-basket. ... My priority is always spending the time with the patient that the patient needs and not being too hurried in the exam room, knowing that I've got ... six MyCharts and whatnot waiting for me. (Clinic 1 PA)

Some providers mentioned addressing secure messages on weekends and days off to avoid having a large backlog when they return to the office. Two providers described how nurses also worked late, helping them to address messages.

4.1.2.1.6. Usability. Clinicians described both facilitators and barriers related to the usability of secure messaging. Many clinicians reported that secure messaging was easy to use because it required “minimal clicks” and they are able to quickly forward the message or reply to the patient.

All I have to do is click forward, type in [the recipient's] name and then click accept. So it's minimal clicks. I don't even have to open the encounter. ... [F]rom the in-basket I can just click on [the message] and click reply to the patient. That opens my reply window... ... So I think it's very user-friendly. (Clinic 5 RN)

Also, one PA said that the subject line of secure messages was useful because he can glance at it to decide whether he should look at the message right away.

An LPN found the use of “dot phrase” shortcuts useful for signing secure messages. Dot phrases are brief phrases (often beginning with a period, e.g., “.vitals”) that can be used to import longer text or structured data into an EHR document.⁵⁵ She has shorter and longer versions of the signatures. For example, to sign a secure message for a certain provider, she would type the correct dot phrase and the provider's name; her name and the clinic name would be added automatically to the message. This saves her time because she does not need to type the same information repeatedly.

Some usability barriers were described by users of both vendor systems. One arises when, instead of creating a new secure message, a patient responds to a message that he or she had received from the clinic at an earlier time. Doing this requires the clinician opening the message

to review all of the content from the previous conversation as well as the new message, which can cause confusion.

Other usability barriers were identified by clinicians in Clinic 1. For example, several nurses and providers described how the organization of a secure message and its replies can be confusing.

INTERVIEWER: So you're going back and forth, up and down?

PHYSICIAN: Yes, ... and like I said, it's hard. Sometimes I go back, and I have to think, okay, which? This one I already read, but where is the next one. And see, my ... response gets mixed in down here again, ... her first note that she sent to me is here. Her next one is here, but here's my note, and here's her first one again. ... But my answers that I get sent back also come in down here. See, here's my notes that I typed above, but it also comes back interspersed in here, and it's duplicated, because there's her note again, there's my note again. ... So in answering her message, you have to figure out that stream of messages and where you are in that stream of messages. (Clinic 1 Physician)

Another usability issue that several clinicians identified is that clicking on a secure message opens it in "preview mode," but only some of the information in a secure message is visible in this mode. To see important information, such as the date the message was sent, the message must be fully opened, which involves clicking on a button within the message being previewed.

Clinic 1 participants identified more usability issues than the other clinics, though each issue was described by only one clinician respondent. A provider was frustrated by the inability to quickly search through secure messages that have previously been sent and received. Another provider was using a note function in the messaging documentation, not realizing until later that these notes are not routed to the nurses.

Usability issues at Clinic 6 were related to understanding how the system works, such as a Clinic 6 provider who sent a secure message to the patient when it should have been sent to the nurse. Similarly, one provider at Clinic 6 assumed the secure messages were being automatically signed, but they were not. Consequently, patients were wondering who had sent them the messages.

4.1.2.1.7. Perceived outcomes. Satisfaction with the technology was a facilitator mentioned by many clinicians. Providers reported that they appreciated being able to address patient issues without bringing every patient into the clinic. Several RNs reported that they appreciated receiving messages from grateful patients.

People will just send in a message saying, hey, thank you for helping us out, ... or helping me out or my kid or my mom or whatever it is. And that's nice, because then we can just quick read it and know that, yay, we helped someone. (Clinic 5 RN)

One facilitator to the use of secure messaging is clinician perception of patient satisfaction. Several clinicians reported that patients had expressed satisfaction with the technology for reasons including ease of reaching the providers and the ability to send information to the clinic when it is convenient. Another reason is that giving frequent updates through secure messaging allows chronically ill patients to keep the clinic updated on their condition.

It's a nice way for [patients with chronic illnesses] to report if there's any changes or they notice something new. ... We have a couple patients that we get daily messages from ... just minor, little updates, but it makes them feel better. (Clinic 5 RN)

Several clinicians discussed how they used secure messaging as patients and like it themselves. One provider mentioned that because secure messaging is so often available to patients in the area, not having it would make patients less satisfied with the clinic. “It’s also sort of an expectation now, at least [in this city]. Like if you’ve been to [any of the three large health systems], MyChart is available, so why isn’t MyChart available here?” (Clinic 6 Physician)

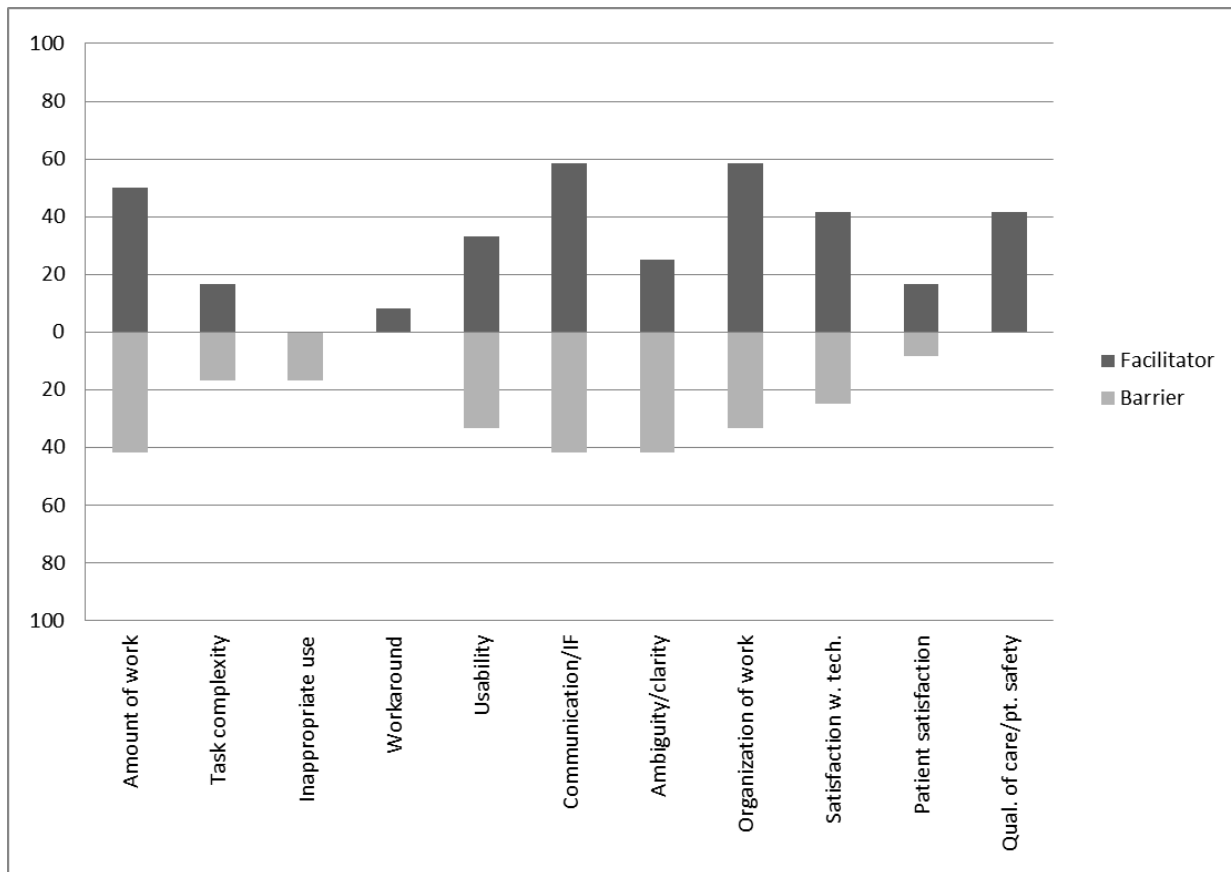
Half of clinicians described the positive impact of secure messaging on quality of care and patient safety. Clinicians stated that the ease of communication encourages patients to more often share information useful for their care. Also, some patients review their medical records on a patient portal and send the clinic messages to correct errors.

[Patients] review their problem list, their immunizations, their medication list, and will say, oh, I’ve had this vaccine. Or I had one last week of a guy who was flagging as due for a diabetic foot exam. But he wrote and said, I had a diabetic foot exam with [my PCP] at my appointment in April. So I went into the office visit from April, and sure enough, she did the diabetic foot exam. So then in [the EHR] I could go into the health maintenance and put that as completed. ... Or this isn’t the dose of the medication I take anymore, my cardiologist changed it. (Clinic 5 RN)

4.1.2.2. Facilitators and barriers to the use of secure messaging identified by clinic staff.

We analyzed a total of 12 interviews and concurrent interviews and observations for staff, including six MAs, four schedulers or receptionists, one clinic manager and one billing specialist. Note that we excluded interview data for the clinic manager at Clinic 1 and the scheduler at Clinic 5 because they did not use secure messaging to communicate with patients. Figure 8 shows the percentage of staff that identified facilitators and barriers related to each dimension.

Figure 8. Facilitators and barriers to the use of secure messaging identified in staff interviews (N=12)



Overall, staff identified facilitators to secure messaging workflow in more dimensions on average (3.3) than barriers (an average of 2.4). Many staff identified facilitators related to communication, the organization of work, the amount of work, satisfaction with the health IT application, quality of care and patient safety, and usability. Barriers were often related to communication, ambiguity, the amount of work, the organization of work, and usability. Table 14 contains the number of staff who mentioned a barrier or facilitator related to each dimension.

Table 14. Facilitators and barriers to the use of secure messaging identified in staff interviews (N=12)

Dimension	Facilitator	Barrier
Amount of work	6	5
Task complexity/simplicity	2	2
Inappropriate use	NA	2
Workaround	1	NA
Usability	4	4
Communication/information flow	7	5
Ambiguity/clarity	3	5
Organization of work	7	4
Satisfaction with technology	5	3
Patient satisfaction	2	1
Quality of care/patient safety	4	0
Mean dimensions per interview (SD)	3.3 (2.2)	2.4 (2.0)

4.1.2.2.1. Communication and information flow. Some of the facilitators identified by clinic staff are similar to those mentioned by clinicians. For example, staff described how secure messaging provides another route of communication between the clinic and patients. Staff also described how family members may use secure messaging to stay informed about the care of their loved ones.

We had a [patient] coming in just almost every day, and ... her daughter and son-in-law are both physicians in another state. So [the PCP] was constantly [messaging] back and forth with them, which helped because they could call their siblings and tell them, this is what's going on. ... And when they could fly out here, they came in with her. ... [In]-between time[s], they could communicate with him. So that was very nice, especially at a very sensitive time, because she was dying. (Clinic 1 MA)

Two MAs described how secure messaging can also be helpful for family members privately sharing information that they would like the provider to know before a patient's office visit, in some cases suggesting that the provider "tiptoe around and talk to [the patient] about it" (Clinic 1 MA).

Staff also reported hearing from patients about the usefulness of secure messaging, particularly for asking brief questions. One staff member said that patients like secure messaging because it allows them to communicate directly with the provider.

[One provider's] patients like using MyChart a lot more because they know he's answering most of the time. And I think that just makes them feel better, rather than calling, [receiving the information] from the horse's mouth makes them a little more comfortable. (Clinic 1 MA)

Another noted that the speed of communication through secure messaging seemed to be faster than a phone call when messages were used for simple questions, such as whether a previous appointment included a physical.

Many of the communication barriers staff identified were similar to those that clinicians reported. Several staff stated that communication can be less clear and more confusing and that patients sometimes report too much information in a single email. Also, staff mentioned that a patient's tone of voice gives useful information that is lost when secure messaging is used.

I had a patient call. She tried to sound like she was okay. Within 20 seconds on the phone, she's burst into tears. She's falling apart. I wouldn't have known that. She could have written a very composed email, and we would have had no idea that she was in such a state of mental anguish if she hadn't called. (Clinic 2 Receptionist)

Another communication barrier is that patients do not read message replies that the clinic sends, sometimes calling the clinic to check about the issue instead. A related barrier is that some patients expect an immediate reply to each secure message, and call the clinic if they do not receive one.

MA: We have patients, they'll send an email and call. Because they felt like you hadn't answered back quick enough.

INTERVIEWER: Because people expect to get an answer within a half an hour or so?

MA: Exactly. (Clinic 2 MA)

Staff in Clinic 2 mentioned an unusual communication barrier. They had received a message from a patient's spouse. Ordinarily, the staff copy the information provided by a family member into the patient's medical records. In this case, they also made sure to indicate that the information was from the patient's spouse because they were not certain if the patient would agree with the information provided.

[The issues reported by the patient's spouse] may not be a problem for [the patient]. ... So, you know, that does get into a tricky situation. [This is] a situation, where, with email, where I attach it to their chart, but it's also something where we take it with a grain of salt. This didn't come from the patient. This came from the patient's spouse. (Clinic 2 Manager)

4.1.2.2.2. Organization of work. Many staff described facilitators related to the organization of work. One was that responding to secure messages is easier than calling patients, particularly because staff cannot include certain types of information in a phone message.

Sometimes the patient calls, and then they go back to work, and they don't answer their phone call even though they just called you, or they're busy. ... I feel like [with] the phone calls there's a lot of phone tag going on. And with the MyChart, ... it's HIPAA protected, and I can say what I need to say without worrying about saying something that shouldn't be said [in a voicemail message]. (Clinic 3 MA)

Like clinicians, staff reported that the use of secure messaging helps patients to manage chronic conditions without requiring the patient to come in for an office visit. In one clinic, diabetic patients are asked to give updates—via secure messaging or phone—on how their medications are working, particularly after medication changes.

Another facilitator was that secure messages are routed to the clinic staff member who can best resolve the issue, saving the patient from having to wait on hold during a phone call to the clinic while some other staff member attempts to resolve it.

[If] the question is [whether] the prior auth[orization] is done yet, [on the phone] you're going to get [a clinic staff member] who goes, just hold on. I have to check on that. [With secure messaging] it gets right to the ... unit clerk, and then she can respond. (Clinic 1 MA)

In clinics that allow attachments to be sent with secure messages, staff reported that having patients send forms to the clinic is helpful. In this case the staff member would print the forms and give them to the provider for signing.

Staff reported only a few barriers related to the organization of work. One is that some patients read the reply to their secure message without following through, for example by making an appointment. If the issue is important, the clinic would call the patient in this case. Also, in Clinic 1, the triage nurse is not always the first person to open each secure message. (If another care team member opens a message and discovers it describes an urgent issue that requires triage by the RN, the staff member will verbally inform the triage nurse about the message so that it can be addressed immediately.)

4.1.2.2.3. Ambiguity or clarity. One MA stated that secure messaging with attached photos is particularly useful for patients whose health status creates ambiguity about where they should receive followup care. This ambiguity can be more easily resolved by the sharing of images.

Sometimes [secure messaging is helpful], especially if patients have ... wounds, and they want to know should I be seen here, or should I go to wound care, should I go to dermatology, it's helpful to see it to know what we're dealing with, rather than say, oh, you've got to come in for an office visit. And sometimes they have to come in for an office visit regardless, but sometimes [not]. (Clinic 1 MA)

Other staff described difficulty determining the status of a secure message and who is working on the message. Sometimes this requires searching through a long string of messages or conducting other research in the patient's medical record.

4.1.2.2.4 Amount of work. Several staff reported that secure messaging reduces their workload compared with addressing the same issues with phone calls because "sending out a 30-second email is much faster than talking to someone" (Clinic 2 manager). Other staff suggested that secure messaging also reduces office visits with nurses.

[If] we didn't have MyChart, we'd ... have more people coming in for nurse visits, ... because if there's a quick question or, oh, hey, I was in the neighborhood, and I thought about this. Instead of being able to send us a MyChart, they'd just come in. (Clinic 1 MA)

One barrier described by an MA is that some patients include a lot of nonclinical information in secure messages, adding to his workload. "I don't like messages where the patient is rambling [about nonclinical information, then asks] can I have a refill?" (Clinic 3 MA)

4.1.2.2.5. Usability. Many staff reported facilitators related to the ease of using secure messaging. One staff member said that the similarity to email was a facilitator.

Clinic 1 has developed shortcuts for frequent types of secure messages, which simplify the work of staff.

MA: [A]n example would be when someone needs a shingles vaccine and they send a MyChart and say I see that I'm due for this. Can I come in and have it? And there's screening questions that we have to ask for that, and they have to check with their insurance. So then I would just MyChart them back and say, yes, but before you come, these are the screening questions that we'd like you to answer, and I'd just send them to them and say, if the answer is yes to any of these, you may not be able to have the vaccine. I would just MyChart them back.

INTERVIEWER: There a [shortcut] for that...?

MA: Yes. (Clinic 1 MA)

Several usability barriers were reported, although each was mentioned by staff of only a single clinic. For example, in Clinic 1, several staff echoed clinicians in reporting that the organization of the secure message was a barrier when one or more replies had been sent.

[The information is organized] date-wise, but down here you have to always keep going. And it's the same thing over and over, the same message. How many times do we need it, right? ... That is annoying. And you finally, usually when you get towards the end you'll see that, oh, well, [the provider] did respond to the patient. (Clinic 1 MA)

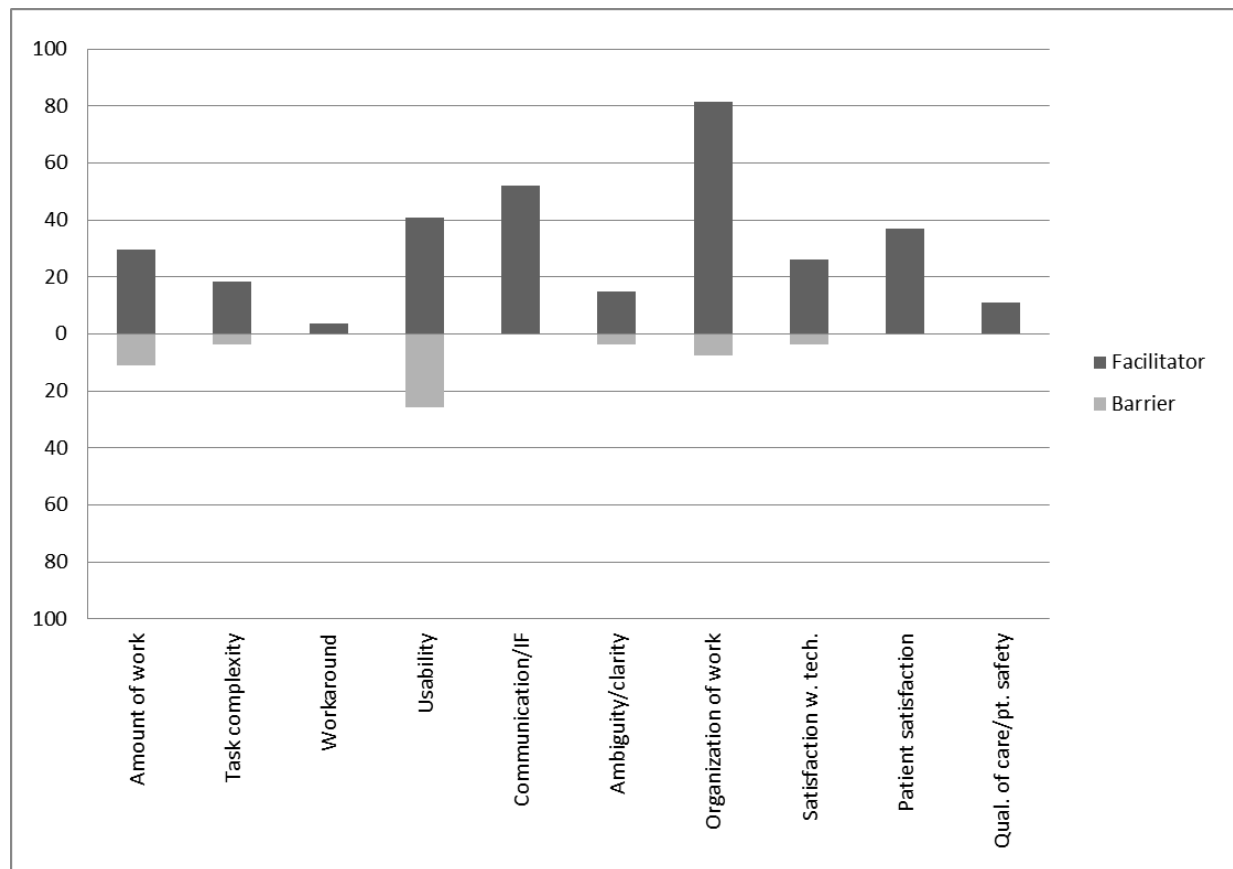
An MA in Clinic 5 reported a barrier related to unexpected changes in the EHR software.

So on the difficult side, [the EHR system] has a way of changing things in the background with no notification, and all of a sudden something that you could do very easily on Wednesday is like ... I can't do what I did yesterday. (Clinic 5 MA)

Finally, the receptionist in Clinic 2 reported that the age and slowness of her computer was a barrier. She rarely uses secure messaging because typing and sending the message takes too long.

4.1.2.3. Facilitators and barriers to the use of secure messaging identified by clinic patients. We analyzed interview transcripts for 27 patients, which included six from each clinic except for Clinic 2 (five patients), Clinic 5 (seven patients) and Clinic 6 (three patients). Patients identified many more facilitators to secure messaging workflow (an average of 3.2 per interview) than barriers (0.6 per interview). Figure 9 shows the percentage of patients who mentioned facilitators or barriers related to each dimension.

Figure 9. Facilitators and barriers to the use of secure messaging identified in patient interviews (N=27)



Facilitators were most often related to the organization of work, communication, satisfaction with the health IT application, usability, and the amount of work. Barriers were mostly related to usability. Table 15 shows the number of patients who discussed facilitators and barriers related to each dimension.

Table 15. Facilitators and barriers to the use of secure messaging identified in patient interviews (N=27)

Dimension	Facilitator	Barrier
Amount of work	8	3
Task complexity/simplicity	5	1
Inappropriate use	NA	0
Workaround	1	NA
Usability	11	7
Communication/information flow	14	0
Ambiguity/clarity	4	1
Organization of work	22	2
Satisfaction with technology	14	1
Quality of care/patient safety	3	0
Mean dimensions per interview (SD)	3.2 (1.50)	0.6 (0.78)

4.1.2.3.1. Organization of work. The vast majority of patients interviewed mentioned facilitators related to the organization of work. Many patients said that secure messaging is helpful because they don't have to call the clinic and spend time on hold.

[You] have to ... wait endlessly for the phone to answer. Are you a [clinic] patient, or are you not? Then it goes, you can now wait. You know, they're busy. So then you wait and wait and wait. If you [write a secure message], the nurse will call you at their convenience and say, hey, how are you doing? (Clinic 6 Patient)

Several patients explained how using secure messaging fits better into their daily routines or their work day, compared with phone calls.

It's very nice just to be able to send a message, because I have a daycare at my house, so I can't sit on the phone and wait, because my kids are not going to allow that. So if I have five minutes that I just need to sit down and type something in, it's so much easier than having to sit on the phone or for [clinic staff] to try to listen [with] a child screaming in the background. (Clinic 3 Patient)

Other patients who worked night or evening hours found messaging to be particularly helpful, as did a patient who did not want to discuss her medical problems where her coworkers could overhear.

Another patient said she had more confidence in the answers she receives using secure messaging than those she receives on the phone from a nurse who is busy with other tasks.

[It's] just easy to get on MyChart and type [rather] than get on the phone and have to talk to somebody who's probably busy with something else. [With a phone call, I feel] like I'm not going to get the right answers. [The nurse] is probably going to be rushed. (Clinic 6 Patient)

A patient with a chronic illness found that her office visits are more efficient when she sends a message prior to the appointment listing the topics she would like to discuss. She is able to think about the important issues related to her health before sending the message, and the provider brings the printed message into the exam room to ensure that none of the topics are missed. The use of secure messaging in this case helps the clinic to provide patient-centered care.

4.1.2.3.2. Communication and information flow. Over half of patients described facilitators related to communication. Many patients mentioned that secure messaging allows them to easily communicate with the clinic as often as they wish. One patient used secure messaging frequently

when she was pregnant. She had “a lot of questions that ... I don’t need an answer right now, but it’s just nice to know that [the clinic] can respond back when they get a chance” (Clinic 3, Patient 2). Another patient who had been frequently hospitalized said that it helped her to handle the changes in medications related to being admitted and discharged from the hospital.

I had to go to the hospital [five times] this summer. ... And so it was easy to just write an email and say, this is what happened, these are the medicines I take, can I still take this other, can I still take it again in pill form, even though I got an IV? Yep, you can still do this. (Clinic 1 Patient)

Some patients stated that communication by secure messaging helps them to share information with the clinic because they are able to take the time to write the message carefully at home, ensuring that all important issues are included. In an office visit, they are more likely to forget some of their questions. Also, many patients stated that secure messaging was useful for questions that were forgotten during an office visit.

I do forget to say things when I’m here. And I like the fact that I can go back, or when I’m driving home, or back to work, I realize I had forgotten that. So I just jump on MyChart and send that message. (Clinic 3 Patient)

Patients also liked the fact that the information they received through secure messaging was written and could be reviewed later.

Several patients stated that they better communicate their medical concerns to the clinic in writing than in a phone call and that the process of writing the secure message helps them to organize their thoughts.

I think sending a message when you’re assembling your thoughts and writing your questions down, it can often come across more succinctly, and you made sure before you send it that you’ve got all the issues out on the table. If you call and you leave a message, you don’t have the record yourself of what you asked, and, you know, you may have just rambled over something and not emphasized the right issues. (Clinic 5 Patient)

One patient said that he found communicating through secure messages more comfortable than sharing information during a clinic appointment, particularly at an academic medical center where residents or other trainees also come into the exam room.

Sometimes I have a hard time talking, especially [at a local academic medical center where they] bring three or four [trainees] in there with you. ... [So] especially when it comes to [that medical center] I always try to use MyChart, because I don’t feel comfortable talking around three or four people who don’t really know my medical condition. (Clinic 6 Patient)

4.1.2.3.3. Amount of work. Several patients mentioned that sending a secure message required less effort than calling the clinic.

[To call the clinic] I’ve got to sit and wait for someone to pick up. I have to tell them my date of birth, I have to tell them who I am, I’ve got to jump through those hoops, then ask for someone’s nurse. I think the phone takes longer. It takes up more people’s time. (Clinic 1 Patient)

Some patients said that they appreciate the fact that with secure messaging, they do not have to make themselves available for a return call from the clinic or to explain their medical issues to multiple people, including the receptionist, the triage nurse, and the provider.

4.1.2.3.4. Usability. Many patients described the usability of the secure messaging system as a facilitator. Most stated that the system is easy to use because the patient portal used by their clinic is self-explanatory. “The links are easy, and they’re listed. So if I want to send a message to my doctor, I just hit the link and the box pops up, and I send a message that I want” (Clinic 3 Patient). Some patients use a mobile app on their smart phones, which allows them to send message at any time and from any location. “I might be at the store, and I want to do a MyChart message. I can just [use] my phone right there” (Clinic 6 Patient).

One patient described a situation where sending a photo with a secure message helped to resolve a medical issue quickly. She had a spider bite and wasn’t sure if she should come in to the clinic or go to the emergency room, because it was near the time that the clinic closed. Her husband took a photo of the bite, attached it to a message and sent it to the clinic. He heard back immediately that she should come in.

Patients generally described few barriers to the use of secure messaging, except those related to usability, which several patient interviewees mentioned. Most of the barriers were described by only one patient. For example, a patient at Clinic 5 said that he had not received an email letting him know that he had received a secure message. A Clinic 1 patient had to choose from the list of all clinic providers when selecting who a message should go to. One patient had trouble deleting the confirmation messages after cancelling an appointment at Clinic 3. She ended up having 25 messages cluttering her inbox. One patient at Clinic 6 was frustrated when he was inadvertently sending duplicates of the same message.

4.1.2.4. Comparison of facilitators and barriers to use of secure messaging identified by clinicians, staff, and patients. Reviewing the facilitators and barriers described by clinicians, staff and patients, we see some interesting patterns. Clinicians are ambivalent toward secure messaging, identifying slightly more barriers than facilitators. Clinic staff have a more positive view of this health IT application, mentioning facilitators more often than barriers. Patients’ views were overwhelmingly positive, except in the area of usability.

Examining facilitators and barriers related to communication provides insight into the reasons for the differing views of each group. All three groups indicated that communication via secure messaging makes it easier for patients to reach the clinic and share information. All agreed that secure messaging makes patients comfortable and improves their relationship with the clinic. Patients also indicated that it helps them to remember topics that they want to discuss with the clinic and to organize their thoughts. However, many clinicians and staff perceived that the health IT application is more beneficial to patients than it is to them.

INTERVIEWER: Is [secure messaging] more useful for the patients or for you or [the physician]?

MA: I think the patients [because it’s an] easier way to communicate with their doctor ... A lot of them say they’re not waiting forever to try and get a live person. (Clinic 1 MA)

Both clinicians and staff stated that messages from patients can be unclear or too complicated. In this situation, triage nurses prefer to speak to the patient on the phone so they can efficiently gather information by asking questions and can also glean useful information from the patient’s tone of voice. Both clinicians and staff become frustrated when patients fail to check their secure messages, ending the communication unexpectedly.

All three groups identified facilitators for patients related to the organization of work—such as the fact that patients do not have to wait on hold or “play phone tag”: “You’re not sitting on a

phone or waiting for someone to call you back and you're not there. So I see from a patient standpoint, it's good" (Clinic 1 PA). Nurses and staff also appreciate this aspect of secure messaging, stating that it is easier to address some simple patient issues by messaging instead of trying to reach the patient by phone. Providers did not perceive this as an advantage, perhaps because they do not typically spend as much time on the phone with patients.

Patients mentioned that secure messaging gives them flexibility to communicate with the clinic at their convenience. Clinicians also like the asynchronous nature of secure messaging, which allows them to efficiently address messages as time permits during the work day. However, some providers feel there is some risk that secure messaging could require increasing amounts of their personal time away from the clinic.

[It's] another way that you feel like the electronic medical record has invaded your soul and life. I can be MyChart messaging patients all night long if I wanted to, honestly, at home, whereas, with a phone call, I can't. So that's a difference. So for people that don't have a great work-life balance, that's not the best thing for them. (Clinic 5 Physician)

In addition, all three groups prefer secure messaging to phone calls at least some of the time, finding that it reduces their workload and makes workflows more efficient. Clinicians and staff both feel that secure messaging can reduce office visits or nurse visits, as care (particularly followup care) is provided without requiring patients to come to the clinic. However, clinicians and staff agreed that some of the messages sent to the clinic do not contain useful clinical information. Clinicians also described various ways that patients could use secure messaging inappropriately, such as sending very long messages, messages with too many issues, or several messages in a short period of time. Overall, providers feel that secure messages shifts work from nurses to providers, increasing their workload and lengthening their work day.

[In] the last three years, there has been that growing cry from the practitioners to say I shouldn't be doing this at 8:00 to 9:00 at night at home ... to get things going for the next day and not have that accounted into my work week because now I'm working 60 hours a week again. (Clinic 1 Physician leader)

Several clinics developed workflows aiming to redistribute the work by having nurses and staff address messages without involving the providers whenever possible. Clinicians reported that this system works but not perfectly. Providers complain that too many messages are routed to them instead of being handled by nurses or staff. One key issue is provider compensation: providers are not paid directly for the time spent addressing secure messages, and they therefore perceive it as extra work. In contrast, patients are sometimes able to receive health care services (e.g., a prescription) without visiting the clinic or paying a co-pay, which is a benefit to them in terms of saved time and money.

I would guess that the dissatisfaction from the physician's standpoint has to do with the fact that it's [work that isn't compensated]. And that has to do a lot with the patient satisfaction too. If you charged for it, and [patients] had to pay [for] it, I think their attitude would change. (Clinic 5 Physician)

4.1.3 Research Question 2: Impact of Sociotechnical Context On Use of Secure Messaging

In this section we examine how the role of the sociotechnical context can affect workflow related to the use of secure messaging. We examined which of the five major aspects of a work system (a person performing various *tasks* using *tools and technology* in a given *environment* within an established *organization*) had an impact on the secure messaging workflow (see Section 2.4 and Figure 1). We describe the sociotechnical context using data from the pre-visit questionnaire, interviews, observations and the Web-based survey. The organizational and technological characteristics of the clinics are summarized in Appendixes T-U.

Our analyses include—

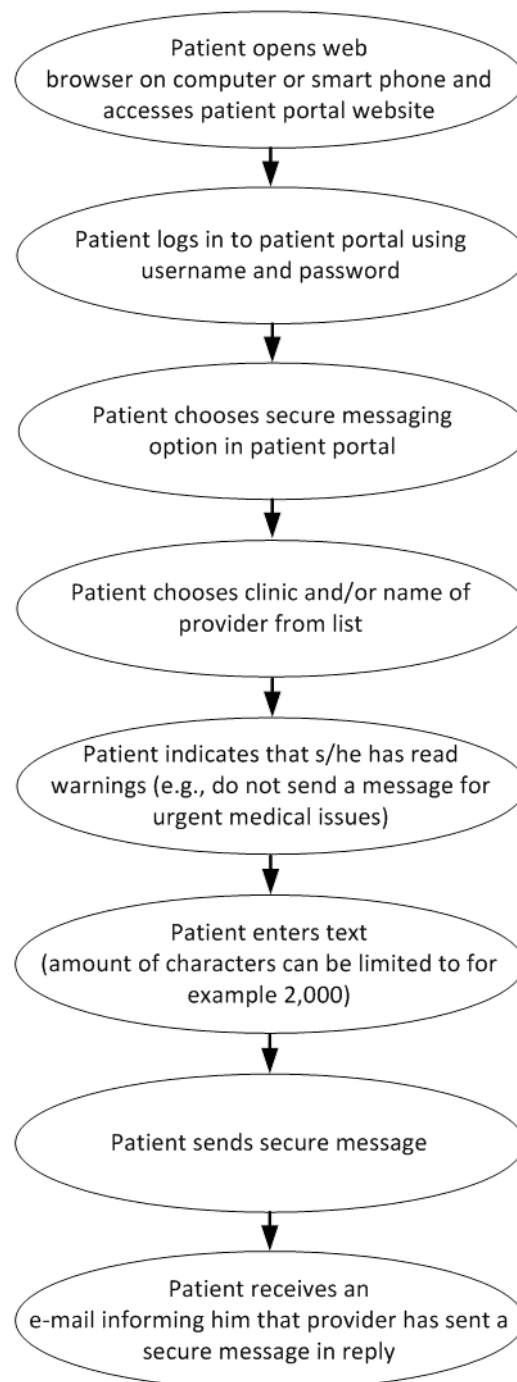
- Comparisons across clinics of clinician, staff, and patient workflows related to secure messaging
- Comparisons across clinics of workflow facilitators and barriers related to secure messaging
- Comparison of user perceptions of secure messaging across clinics
- Descriptions of the impact of sociotechnical differences on secure messaging workflow

4.1.3.1. Comparison of clinician and staff workflow for secure messaging across clinics.

The workflow Figures 2–6 in Section 4 show that there are basically two workflows for secure messaging: a provider triage workflow (Clinic 2) and a nurse triage workflow (Clinics 1, 3, 5, and 6). In the first workflow (Clinic 2) the provider triages incoming secure messages and addresses most of them. Messages that can be addressed by support staff are forwarded to them. Note that this clinic also receives a large number of nonsecure emails that are addressed primarily by the clinic manager. In the second workflow (used by the clinics that implemented a patient-centered medical home (PCMH) model of care) an RN triages the incoming messages and distributes them. This model is used in Clinics 1, 3, 5, and 6. There are variations in the second secure messaging workflow, depending on the degree to which care team members work at the top of their licensure. In Clinic 1, LPNs and MAs are involved in the secure messaging workflow, opening secure messages throughout the day and addressing all those within their capabilities. In other variants, the RNs address approximately half of secure messages themselves and forward to the provider those that require his/her attention. MAs and LPNs rarely address secure messages in this variant. The different models have an important impact on workflow in the clinic. Note that large variations in workflow often exist within clinics as well. Some providers address nearly all secure messages themselves, while other providers in the same clinic may instead instruct their nurses to schedule office visits for all patients who contact them by secure messaging.

4.1.3.2. Comparison of patient workflow for secure messaging across clinics. The patient workflows for secure messaging are relatively straightforward (see Figure 10). In four out of five clinics with secure messaging, the same patient portal (Epic MyChart) is used. There are some minor variations in the patient workflows at these four clinics; for example, in Clinic 1 the warnings about appropriate content for secure messages have several check boxes that the patient is required to click to indicate having read the warnings, while at Clinics 3 and 5 the patients need only click one check box. The differences between Clinic 2 and the other clinics are also minor. For example, the layout of one patient portal has tabs at the top instead of links on the left side. Except for these minor differences, the workflow for patients is very similar across all five clinics.

Figure 10. Patient workflow for secure messaging



4.1.3.3. Comparison of facilitators and barriers to the use of secure messaging across clinics. In this section we compare facilitators and barriers to the use of secure messaging across clinics, for clinicians, staff, and patients.

4.1.3.3.1. Comparison across clinics of facilitators and barriers to the use of secure messaging: clinicians. Table 13 summarizes the facilitators and barriers to secure messaging for clinicians in each clinic. Using the interview data, we summarized the facilitators and barriers in Tables 16–18. For definitions of the barrier and facilitator dimensions, see Section 3.6.1.

Table 16. Comparisons of the facilitators and barriers to secure messaging identified in clinician interviews (N=38)

Dimension	Clinic 1 (N=11)		Clinic 2 (N=1)		Clinic 3 (N=5)		Clinic 5 (N=12)		Clinic 6 (N=9)		TOTAL (N=38)	
	Facilitator	Barrier	Facilitator	Barrier	Facilitator	Barrier	Facilitator	Barrier	Facilitator	Barrier	Facilitator	Barrier
Amount of work	45%	73%	100%	100%	60%	40%	58%	50%	11%	11%	46%	49%
Task complexity	18%	36%	0%	100%	0%	0%	8%	25%	0%	0%	8%	22%
Inappropriate use	NA	73%	NA	100%	NA	100%	NA	42%	NA	44%	NA	62%
Workaround	18%	NA	0%	NA	0%	NA	8%	NA	0%	NA	8%	NA
Usability	27%	82%	0%	100%	40%	20%	25%	25%	11%	56%	24%	51%
Communication/ information flow	73%	73%	100%	100%	100%	80%	67%	83%	67%	89%	76%	84%
Ambiguity/clarity	27%	36%	0%	100%	0%	20%	0%	42%	0%	56%	8%	43%
Organization of work	64%	64%	100%	100%	80%	60%	75%	25%	22%	33%	62%	46%
Satisfaction with technology	27%	27%	100%	0%	80%	20%	42%	8%	33%	22%	43%	19%
Patient satisfaction	55%	18%	0%	0%	80%	20%	33%	33%	56%	0%	51%	19%
Quality of care and patient safety	45%	55%	100%	0%	80%	20%	50%	8%	33%	11%	51%	24%

Results in Table 16 show many similarities in how clinicians across clinics perceive facilitators and barriers to the use of secure messaging, especially if we exclude the results of Clinic 2, which has only one provider. Facilitators related to communication and information flow are mentioned frequently in almost all clinics. Over two-thirds of clinicians in each clinic mention facilitators related to this dimension. Interestingly, barriers related to communication and information flow are also frequently identified in all clinics, and are mentioned by over 70 percent of clinicians. Facilitators related to the organization and amount of work are also frequently mentioned, though less often by clinicians in Clinic 6 than in the other clinics. One possible explanation is the extremely low volume of messages in this clinic. We will further discuss the effect of message volume on workflow in Section 4.1.3.5.1.

Another barrier to secure messaging that was frequently mentioned is inappropriate use. This barrier was identified by a majority of clinicians in Clinics 1, 2, and 3, and nearly half of those in Clinics 5 and 6. Usability and amount of work are also barriers that were most often mentioned by clinicians in Clinics 1 and 2 and not as often by clinicians in Clinics 3, 5, and 6. These differences may also be due to variation in the volume of messages.

4.1.3.3.2. Comparison across clinics of facilitators and barriers to the use of secure messaging: staff. Table 17 summarizes the facilitators and barriers to secure messaging identified by staff in each clinic. Note that the results in this table are based on relatively few interviews, six in Clinic 1, four in Clinic 2, and two in Clinic 3. Staff in Clinic 5 and 6 were not involved in the use of secure messaging; thus, they did not provide data.

Table 17. Comparisons of the facilitators and barriers to secure messaging identified in staff interviews (N=12)

	Clinic 1 (N=6)		Clinic 2 (N=4)		Clinic 3 (N=2)		Total (N=12)	
Dimension	Facilitator	Barrier	Facilitator	Barrier	Facilitator	Barrier	Facilitator	Barrier
Amount of work	50%	33%	50%	50%	50%	50%	50%	42%
Task complexity	0%	0%	50%	25%	0%	50%	17%	17%
Inappropriate use		17%		0%		50%		17%
Workaround	0%		25%		0%		8%	
Usability	33%	17%	0%	50%	100%	50%	33%	33%
Communication/ information flow	50%	17%	50%	75%	100%	50%	58%	42%
Ambiguity/clarity	33%	50%	25%	25%	0%	50%	25%	42%
Organization of work	33%	17%	75%	50%	100%	50%	58%	33%
Satisfaction with technology	33%	0%	50%	50%	50%	50%	42%	25%
Patient satisfaction	0%	0%	50%	0%	0%	50%	17%	8%
Quality of care and patient safety	33%	0%	0%	0%	100%	0%	33%	0%

The results in Table 17 show that—like clinicians—staff most often identified facilitators related to communication and information flow, and the organization and amount of work. Interestingly, staff in Clinic 1 identified barriers related to ambiguity and clarity more often than staff of the other clinics. This finding is most likely caused by the way that PCMH has been implemented in Clinic 1. Inboxes are shared by a care team, which means that 5–6 people are sharing the work of addressing messages. Confusion related to the division of work is a barrier in this situation.

Staff of Clinic 2 do not mention usability of the system as a facilitator, and mention usability as a barrier relatively often. One explanation for the differences is that Clinic 2 uses a different EHR than Clinics 1 and 3, so the design of the EHR could be a factor. A second explanation is that staff of the clinic respond to patients' emails as well as secure messages. Email is easier to use than secure messaging because there are fewer steps involved, and usability of the secure messaging system may appear to be lower in this direct comparison with email.

4.1.3.3.3 Comparison across clinics of facilitators and barriers to the use of secure messaging: patients. Table 18 summarizes the facilitators and barriers to secure messaging for patients across clinics. The facilitator most often mentioned (by 60–100 percent of patients we interviewed in each clinic) is that secure messaging improves the organization of work. Patients appreciate having the ability to write messages when the clinic is closed and being able to avoid phone tag with clinic staff. Communication and information flow is another common facilitator, although the number of patients mentioning it varied substantially across clinics (33–67 percent).

The percentage of patients mentioning usability as a facilitator also varied widely across the clinics (0–83 percent). This may in part reflect differences in the extent to which patients we interviewed have used the health IT application. Our data collection method was to interview patients who were in the clinic during our site visit, and in some clinics (e.g., Clinic 6), we had difficulty finding patients present on those days who had experience with the application. The patients interviewed in Clinic 1 generally had more experience in using the health IT application than those in the other clinics, which may explain why they reported more usability facilitators. Many of the patients interviewed in Clinic 2 were former users of the secure messaging system who had switched to communicating with the clinic by nonsecure email. Overall, patients mentioned few barriers to the use of this health IT application. The most frequently reported barrier to secure messaging, mentioned by 26 percent of patients, is usability of secure messaging.

Table 18. Comparisons of the facilitators and barriers to secure messaging identified in patient interviews (N=27)

	Clinic 1 (N=6)		Clinic 2 (N=5)		Clinic 3 (N=6)		Clinic 5 (N=7)		Clinic 6 (N=3)		TOTAL (N=27)	
Dimension	Facilitator	Barrier	Facilitator	Barrier	Facilitator	Barrier	Facilitator	Barrier	Facilitator	Barrier	Facilitator	Barrier
Amount of work	33%	17%	20%	0%	50%	33%	14%	0%	33%	0%	30%	11%
Task complexity	17%	0%	40%	0%	33%	17%	0%	0%	0%	0%	19%	4%
Inappropriate use		0%		0%		0%		0%		0%		0%
Workaround	0%		0%		17%		0%		0%		4%	
Usability	83%	17%	0%	20%	50%	17%	29%	29%	33%	67%	41%	26%
Communication/ information flow	50%	0%	40%	0%	67%	0%	57%	0%	33%	0%	52%	0%
Ambiguity/clarity	17%	17%	0%	0%	17%	0%	29%	0%	0%	0%	15%	4%
Organization of work	83%	0%	60%	0%	100%	33%	86%	0%	67%	0%	81%	7%
Satisfaction with technology	17%	0%	60%	0%	83%	17%	43%	0%	67%	0%	52%	4%
Quality of care and patient safety	33%	0%	0%	0%	0%	0%	14%	0%	0%	0%	11%	0%

4.1.3.4. Comparison of user perceptions of secure messaging across clinics. In the survey, we asked several questions about user perceptions of secure messaging and its effects on workflow. Table 19 summarizes the results for clinicians and staff. Note that only clinicians and staff who reported that they used secure messaging were asked to complete these questions. Responses ranged from (1) strongly disagree to (5) strongly agree.

Table 19. How much do you agree or disagree with the following statements about: Perceived impact of secure messaging on workflow, clinicians (C), and staff (S) by clinic

	Clinic 1		Clinic 2		Clinic 3		Clinic 5		Clinic 6		Total	
	C N=16	S N=8	C N=1	S N=1	C N=4	S N=1	C N=13	S N=0	C N=9	S N=0	C N=48	S N=10
Secure messaging makes communication with patients more efficient.	3.52	3.75	4.00	4.00	4.25	4.00	3.46	NA	3.44	NA	3.56	3.87
Overall, secure messaging saves me time.	2.76	3.63	4.00	4.00	3.75	4.00	2.69	NA	2.44	NA	2.79	3.67
Secure messaging has a negative effect on my workflow.	3.29	2.63	2.00	2.00	2.00	2.00	2.54	NA	3.00	NA	2.90	2.53
Secure messaging reduces my workload.	2.29	3.25	4.00	4.00	3.00	4.00	2.54	NA	2.11	NA	2.40	3.13
The information I get from secure messaging makes my work easier.	2.86	3.5	4.00	5.00	2.75	-	2.92	NA	3.11	NA	2.83	3.67
Secure messaging has a positive impact on patient satisfaction.	3.90	3.75	4.00	4.00	4.50	4.00	3.54	NA	4.00	NA	3.88	3.73
Secure messaging improves the quality of patient care.	3.19	3.63	4.00	4.00	4.25	3.00	3.23	NA	3.00	NA	3.27	3.64
Overall, I am satisfied with secure messaging.	3.29	3.63	4.00	5.00	4.50	4.00	3.67	NA	3.33	NA	3.51	3.87
Scale User Experiences with Secure Messaging	3.17	3.56	4.00	4.25	3.92	3.86	3.25	NA	3.08	NA	3.26	3.62

Results in Table 19 show that most survey respondents were clinicians, not staff. Of the few staff who reported using secure messaging (N=10), 80 percent worked in Clinic 1. In Clinic 1, where comparisons between staff and clinicians can be made, we see that staff are generally more positive about secure messaging than clinicians, except for the item about the impact of secure messaging on patient satisfaction. Both clinicians and staff agree that secure messaging improves the satisfaction of patients.

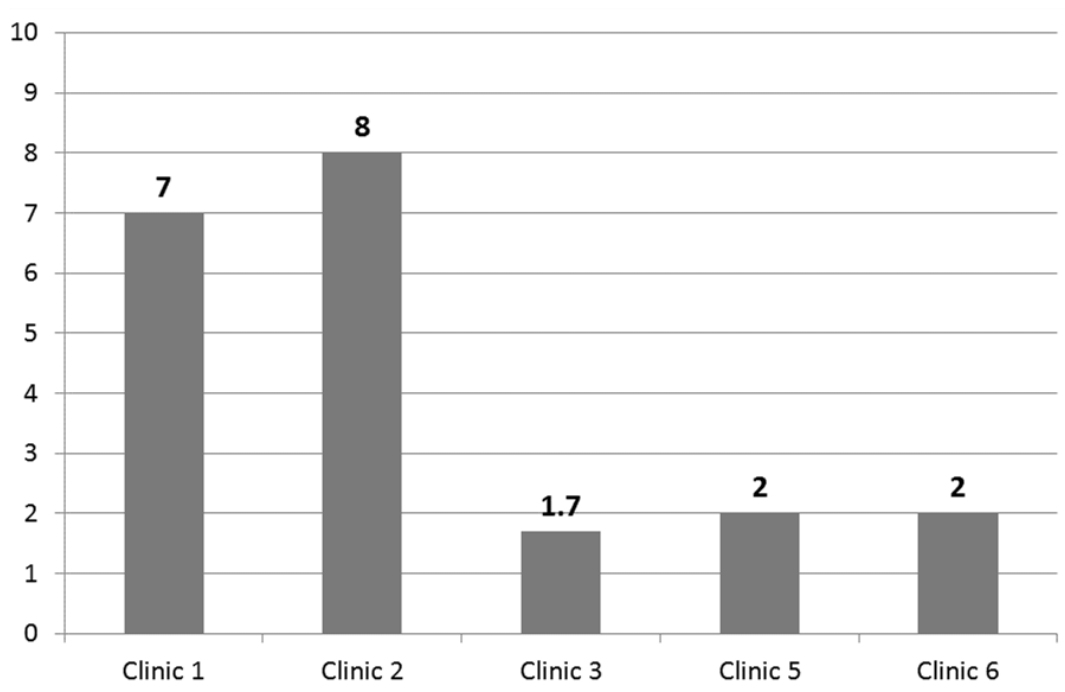
Comparing clinician perceptions across clinics also produces interesting results. Clinicians working in Clinics 2 and 3 are generally much more positive about secure messaging than those in the other clinics, and the average responses for Clinics 1, 5, and 6 are similar. These responses need to be considered while keeping in mind the volume of messages received at each clinic. Clinicians from Clinic 6 were least likely to agree that secure messaging saves them time, reduces their workload, or improves the quality of patient care. These responses may be due to the low volume of messages at this clinic, which makes it difficult for secure messaging to have much of an impact on workflow. In Clinics 1 and 2, the high volume of messages does have an impact on workflow, but the perceptions of clinicians differ. Similarly, patient message volume cannot explain the differences in the responses of clinicians at Clinic 3 and 5. The volume of messages at the two clinics was very similar, but clinicians at Clinic 3 are generally more positive about the health IT application than clinicians at Clinic 5.

4.1.3.5. Effects of sociotechnical context on secure messaging workflow. Theoretically, the sociotechnical context consists of five work system elements: the organization, the environment, the tools and technology, the task, and the person. Implementation of secure messaging obviously had an impact on the tasks that clinicians and staff need to perform. However, in this project the tasks are embedded in the workflow, and therefore it is difficult to disentangle the task from the workflow. Results of our analysis did not show a specific impact of the physical environment on the secure messaging workflow. Therefore, we focus on elements of the sociotechnical context related to the technology, the organization, and the person.

4.1.3.5.1. Technology. Two characteristics of secure messaging play an important role in the related workflow: how long ago secure messaging was implemented and the volume of secure messages. The time since IT implementation is important for several reasons. First, uptake of the health IT application is a slow process. The literature shows that the number of patients enrolling to use a patient portal grows slowly after implementation and the number of active users increases even more slowly.^{12, 13} The volume of patient-provided information therefore also increases slowly over time, so the impact on workflow depends on the time since implementation (see Table 25 and Figure 11). Clinics that receive a few secure messages per week (e.g., Clinic 6) handle each message differently than clinics that receive 100 messages (e.g., Clinic 1). Third, a longer history of use and a larger volume of messages provide the clinicians and staff with both time and incentive to change their workflow, and possibly to intentionally redesign workflow to accommodate the volume of messages. (See Section 4.1.4 for a description of workflow redesign in Clinic 1.)

Figure 11 shows the number of years since secure messaging implementation in the clinics (see Appendix U for details).

Figure 11. Number of years since secure messaging implementation by clinic



Results in Figure 11 show important differences in the number of years that secure messaging has been in use across the clinics in this study. Clinics 1 and 2 have 7–8 years of experience with secure messaging, while Clinics 3,[†] 5 and 6 have 2 or fewer years of experience.

As was described in Table 12, the volume of messages varies substantially across clinics. Clinic 1 receives 10–12 secure messages per provider each day, and the single physician in Clinic 2 receives 15–20 secure messages and 15–20 nonsecure emails each day. In contrast, Clinics 3 and 5 each receive four to six secure messages per provider each day, while Clinic 6 receives one message or fewer per provider each day.

In addition, Table 20 shows clinician and staff estimates of what percentage of patients they communicate with via secure messaging. Results show first that staff in Clinics 5 and 6 do not use secure messaging. Second, the results show that most clinicians and staff report using secure messaging to communicate with approximately 1–25 percent of patients. Third, there are statistically significant differences between the clinics in the percentage of patients that clinicians and staff report they communicate with using secure messaging ($\chi^2=22.5$, $df=12$, $p<0.05$), with clinicians and staff in Clinic 1 using secure messaging with a higher percentage of patients than those in Clinics 5 and 6. Most clinicians and staff in Clinics 5 and 6 use secure messaging to communicate with 1–10 percent of patients.

[†] Note that although Clinic 3 has existed for only 18 months, the larger HCO of which it is a part has existed for many years and implemented the EHR system with a patient portal and secure messaging more than 5 years ago.

Table 20. Responses to the question “With what percentage of your patients do you communicate by secure messaging?” for clinicians (C) and staff (S), by clinic

	Clinic 1		Clinic 2		Clinic 3		Clinic 5		Clinic 6		Total	
	C N=16	S n=13	C N=1	S N=1	C N=4	S N=1	C N=13	S N=0	C N=9	S N=0	C N=43	S N=15
1–10%	25%	15%	0%	0%	50%	0%	61.5%	NA	66.7%	NA	46.5%	13.3%
11–25%	38%	39%	100%	100%	25%	100%	30.8%	NA	33.3%	NA	34.9%	46.7%
26–50%	38%	39%	0%	0%	0%	0%	7.7%	NA	0%	NA	16.3%	33.3%
>50%	0%	8%	0%	0%	25%	0%	0%	NA	0%	NA	2.3%	6.7%
Total	100%	100%	100%	100%	100%	100%	100%	NA	100%	NA	100%	100%

The volume of messages can affect workload. Most providers try to address secure messages during their work day, between office visits, but often at the end of the day they have several messages remaining that require attention. As was discussed in Section 4.1.2.1.5, providers with a high volume of messages may find themselves working long hours. Given the higher volume of messages received when compared with Clinics 3, 5, and 6, this may partially explain why clinicians in Clinics 1 and 2 were more likely to identify barriers related to the amount of work (see Table 16).

4.1.3.5.2. Organization. Several factors related to the organization affect secure messaging workflow: the organizational structure, the number of part-time employees, access to health IT support and EHR data, and the patient population.

The first organizational factor that has an impact on secure messaging workflow is the organizational structure in the clinic. As was described in Section 4.1.3.1, the four clinics (Clinics 1, 3, 5, and 6) that implemented a PCMH model of care have very similar workflows. The workflow in Clinic 2, which has a single provider working with clinic staff, is organized differently because the provider is responsible for triage and responding to all secure messages.

A second organizational factor that has an impact on secure messaging workflow is the number of part-time employees in a clinic. Part-time employees generally have less experience working with health IT and may not have access to training. Training in most clinics occurs in weekly or monthly sessions held during lunch breaks, in which clinicians and staff are taught how to use new health IT applications and informed about changes in health IT systems. In clinics with many part-time employees (e.g., Clinic 6) some clinicians and staff are not present on the day that the training is offered. Using data from the survey, we examined the impact of participation in training on use of and satisfaction with secure messaging. Results (see Table 21) show that there are statistically significant differences in use of secure messaging and satisfaction with the health IT application between respondents who had received training and those who had not. Clinicians who have received training use it more often and are more satisfied with the application.

Table 21. Secure messaging use and satisfaction by training received

	Received training in secure messaging	
	Yes (N=43)	No (N=16)
With what percentage of your patients do you communicate by secure messaging? ^{*,#}	2.09	1.29
Clinician satisfaction with secure messaging ^{*,^}	3.34	3.00

*, ** Differences between the groups are statistically significant at $p < 0.05$ and $p < 0.01$

On a scale of: 1=1–10% of patients; 2=11–25%; 3=36–50%; and 4=>50% of patients

^ On a scale from 1: not satisfied at all to 5: very satisfied

A third organizational factor is whether the clinic has access to health IT support and EHR data in analyzable formats. Two of the clinics studied (Clinics 1 and 3) are part of larger HCOs, and have access to health IT support from a centralized HCO help desk. Staff at these clinics were able to request changes to the secure messaging system that would make the health IT application better fit their workflow, although the HCO did not always make these changes. These clinics also have direct access to EHR data not only for patient care, but also in a format that supports analysis. The clinic manager for Clinic 1 is able to create new reports using data from the EHR system and analyze clinic workflow. (See Section 4.1.4 for the outcomes of this clinic's workflow analyses.) The clinic manager in Clinic 3 was filling the position temporarily and did not know how to create such reports, but was able to extract data from the EHR with help from health IT support staff. The three other clinics are independent (Clinics 2, 5, and 6) and have varying access to health IT support and EHR data. Clinics 5 and 6 purchased their EHR from local large HCOs and are therefore dependent for health IT support on the HCO that purchased the EHR. Giving health IT support to small affiliated clinics is not always a high priority for the HCO, and these clinics have had little success in requesting changes to the secure messaging system. They are also unable to access the EHR data without submitting a formal request to the HCO and waiting for the request to be filled, sometimes after a week or longer. This limits their ability to analyze clinic workflow. Clinic 2 uses an EHR created by a small vendor. As one of the early implementers of this EHR, the provider has a personal relationship with the vendor's CEO, and is able to request changes to the EHR as needed. The clinic reported that such changes are usually made within a week. Staff at this clinic was unsure whether they had access to the EHR data for analysis, because they had not tried to access it or create customized reports.

A sixth organizational factor that may have an impact on secure messaging workflow is the patient population. Clinic 6 attributed the low use of secure messaging (see Table 13), in part, to the socioeconomic status of its patient population, explaining that some low-income patients may not have the equipment (computer or smart phone) or the Internet access required to access the patient portal. Also, several clinicians at Clinic 5 stated that their clinic's secure message volume is low because they have many elderly patients who do not have the interest or technological ability to use a patient portal. In addition, approximately 40 percent of the patients of Clinic 6 are Spanish-speaking, and this clinic does not have a patient portal in Spanish because it was not available from the HCO that provided the clinic's EHR. Although some of the clinic's Spanish-speaking patients are comfortable enough with English to use the 'patient portal, most are not and declined to sign up for the portal. One nurse in Clinic 6 pointed out that use of a Spanish-language portal would create additional workflow barriers, as the few staff who are fluent in Spanish would need to be available to triage any secure messages in Spanish, and the messages would probably need to be translated and saved in the EHR for staff who are not fluent.

4.1.3.5.3. Person. Several important factors are related to the characteristics of the person in the work-system model: job position (i.e., clinician or staff) and individual differences within job positions. Results of this study have shown that across clinics secure messaging has a bigger impact on the work of clinicians, and more specifically on the work of providers, than on the work of clinic staff (see Tables 24 and 25). However, there is also much variation within clinics. The secure messaging workflows vary within a clinic, mainly in response to the preferences of the providers. Some providers are enthusiastic about secure messaging, seeing it as an opportunity for patient empowerment and a way to improve patient-provider communication. However, other providers view secure messaging as task that is added to their daily workload and for which they are not reimbursed. They often prefer not to reply to secure messages, and ask patients who have sent messages to instead schedule an office visit. This explains the wide range of responses from clinicians about the percentage of patients they communicate with via secure messaging (shown in Table 20). In most clinics, the majority of clinicians use secure messaging to communicate with 10 percent of patients or fewer, but a sizable minority communicate with 11–25 percent of patients or even 26–50 percent.

Differences in provider preferences also affect workflow. Providers teach the triage nurses who work with them to follow their preferred care team workflow when addressing secure messages. Some prefer the triage nurses to read the incoming secure messages, do research (such as reviewing the patient’s medical history, health issues, and medication list), and attach a recommended plan for care when forwarding the patient’s message to the provider. Other providers prefer to have nurses just forward the patient’s message to them without additional information. Some providers’ preferences vary related to other factors, such as how well they know the patient. Several providers saw nurses’ failure to follow their preferred workflow as a barrier.

4.1.3.6. Summary: Sociotechnical context and the use of secure messaging. Several aspects of the sociotechnical context have an effect on secure messaging workflow. Organizational factors that we identified include the organizational structure, the number of part-time employees, access to health IT support and analyzable EHR data, and the patient population. Technological factors are length of time since IT implementation and volume of secure messages. Person-related factors that influence the workflow are individual preferences of providers with regard to secure messaging, and their preferred workflows for addressing messages.

In comparing the facilitators and barriers to secure messaging workflow across the clinics, we discovered that overall the facilitators and barriers are similar. This suggests that secure messaging has effects on workflow that are constant, regardless of the sociotechnical context in which the health IT application is used.

One aspect of the sociotechnical context that appears to have a large impact on workflow is the volume of secure messages. For example, Clinic 6 receives a very low volume of secure messages each day, and, perhaps consequently, clinicians in this clinic identify relatively few facilitators and barriers to use of the health IT application, and perceive less impact of secure messaging on their workflow. Some differences in user perceptions of the application cannot be explained by message volume, however. Clinics 3 and 5 had a very similar volume of messages but the survey responses indicated that the clinicians in Clinic 3 had a more positive view of the health IT application and its effects on workflow than those in Clinic 5. Interestingly, a closer examination of the facilitators and barriers identified by the clinicians in these clinics shows that there are few differences between the two clinics, except in the area of outcomes. The clinicians

in Clinic 3 more frequently identified facilitators related to satisfaction with the health IT application, patient satisfaction, and quality of care and patient safety, which may explain their more positive perceptions of the application.

4.1.4 Research Question 3: Use of Patient-Provided Information for Workflow Redesign Related to Secure Messaging

The third research question asks “How do clinics redesign their workflow to incorporate the capture and use of patient-related information?” As is discussed in Section 3.6.2, we define redesign as an *intentional* process, one that is undertaken deliberately by clinic staff. . Although incidental workflow changes may occur because of the IT implementation, such as a decrease in the amount of data entry after implementation of an e-form, these changes are described instead as facilitators or barriers under research question 1.

In most cases, the clinics studied have not redesigned their workflows to incorporate secure messaging. One reason for this is that, in most clinics, patients are not frequently using the health IT applications to report information to the clinic. For example, Clinic 6 received 22 secure messages in the week we collected data, which would be an average of one message read by each triage nurse per day. Some messages are resolved by the nurses, so the providers would receive at most one message per day. This number of messages does not substantially add to the workload of nurses or providers, so clinic leaders do not perceive the need to redesign workflows.

Another reason that clinic leaders are not redesigning clinic workflows is that information reported electronically is being incorporated into existing workflows. For example, triage nurses at Clinics 3 and 6 reported that they address secure messages in the same way as telephone messages sent to them by reception staff.

I do the phone calls, and I do the [secure messages]. And whatever is going on, if the patient says ... I was up last night. My right knee is really bothering me. I'll probably shoot something back to them, what have you done the last 24 hours? Any twisting, bending, anything like that, and then we just kind of go back and forth. It would be basically the same thing as a phone call. ... To me, phone call [secure message], I still got to deal with them. So it doesn't really matter. (Clinic 3 RN)

At these clinics, the relatively light volume of secure messages allows the triage nurses to include them in the established workflow for telephone messages without difficulty. As we describe below, the higher volume of messages at Clinic 1 led to workflow redesign.

Finally, leaders in several clinics do not have easy access to the EHR data that they would need to analyze and redesign their workflows. Because of their dependency on the larger health care organizations who allowed them to share their EHR system, the clinic leaders in Clinics 5 and 6 are not able to create customized reports describing the clinic's EHR data.

I'm not sure if we can even pull that [data] up. ... [T]he challenge that we have is the data is owned by [the health system that purchased the EHR], so we have to request it through [them] in a certain way. (Clinic 6 Manager)

Similarly, leaders in Clinic 5 cannot access data about the number of secure messages received per week without sending a request to the HCO that owns their EHR.

We identified one clinic that redesigned workflow related to secure messaging. Clinic 1 has been using secure messaging for seven years and at the time of data collection, received 100–150

messages per day. Several years after implementation, clinic leaders became aware that the number of messages was causing provider dissatisfaction.

Bluntly, the doctors started saying, well, of course you're getting something from us for nothing. And so the tension starts developing. ... How do I manage the time as that percentage increased ... and what credit do I get for doing that work? (Clinic 1 Physician Leader)

The clinic is organized in care teams that share an "in-basket" in the EHR. The in-basket holds a variety of electronic communication, including secure messages, phone messages, requests to renew medications, and test results. Clinic leadership, including the provider leader and clinic manager, used Six Sigma methods to formally evaluate and improve the process used to handle information coming into a care team, including the in-basket. One change that came from this process analysis was to have nurses and MAs address a larger share of the in-basket volume.

[We assessed the] flow of information, whether it came in as paper, whether it came as phone, whether it came as secure messaging. And [tried] to really be more consistent on how we run that through the care team so everyone does work at their highest level of licensure ... And so we did an in-basket reduction, and it really did seem clear that you could reduce volume and time 20 percent [before] it got to a physician if you just did that. (Clinic 1 Physician Leader)

Another change was to have triage RNs, LPNs, and MAs address messages in the in-baskets of other care teams when time permits. The clinic manager continuously monitors the volume of in-baskets and adjusts clinic staffing accordingly.

I monitor the volume of the in-baskets on a daily basis, so how many different types of messages they have in there ... based on complexity. And if we have additional staff, if a provider is out or if there's an additional float staff from another department, then I can plug them in to help. (Clinic 1 Manager)

A more recent change was to evaluate differences in the amount of time required for providers to address their in-baskets and compensate providers who have more in-basket work. One impetus for this was the health care system implementing a guideline that a full-time provider should have 35 schedulable hours of patient contact per week.

There was a bit of pushback and some good questions from management and providers regarding the non-face-to-face work that's done, specifically on the computer. So then they went back and they started looking at in-basket volumes between the different specialties. [The physician leader] did a lot of work in terms of identifying high complexity in-basket [messages] that take more time. (Clinic 1 Manager)

Specifically, the provider leader divided in-basket items into "high priority" communications that "might or do lead to clinical action." High priority includes secure messages, phone messages, laboratory results, and other time sensitive messages. Items that are "read only," such as a report from another provider, are considered low priority because the information is in the record and the message is not viewed as helping the provider to deliver care. To compensate providers with a higher-than-average number of high priority in-basket communications, the required number of schedulable hours was decreased by one or two hours per week.

So we started turning that into time allowances to take them down from their contact hour requirement if they met certain thresholds of volume of in-basket. So if you exceed a certain percentile of that range in your specialty, you will get an hour to do that. And that's been pretty well received. ... That's starting to soften the blow of [high messaging volume] because it's acknowledging the time they're spending. (Clinic 1 Physician leader)

4.2 E-forms

4.2.1 Description of Health IT Applications and Workflow

Three clinics in the study use some type of e-form. One provider in Clinic 1, who treats a large number of patients for chronic headaches, uses an e-form for migraine patients. Clinic 4 uses two e-forms. The first is a Signs and Symptoms (S&S) e-form that asks patients to report their current symptoms before each office visit. The second, the patient-reported outcomes (PRO) e-form, was originally designed to collect research data using several validated questionnaires, but is also used for patient care. One month prior to our data collection, Clinic 6 implemented a very brief e-form that was sent to patients through their patient portal before each appointment with a primary care provider. However, because of the short time frame since implementation, few interviewed clinicians and none of the interviewed patients were aware of the e-form at Clinic 6. We therefore focus our analysis on the e-forms used by Clinics 1 and 4. All e-forms in these clinics are stand-alone systems that cannot transmit data electronically into the EHR.

Because we were able to collect data on the use of e-forms only in Clinic 4 and from one care team in Clinic 1, we do not have sufficient data to analyze the effect of the sociotechnical context on workflow for e-forms. We therefore address research questions 1 and 3 in this section, but not research question 2.

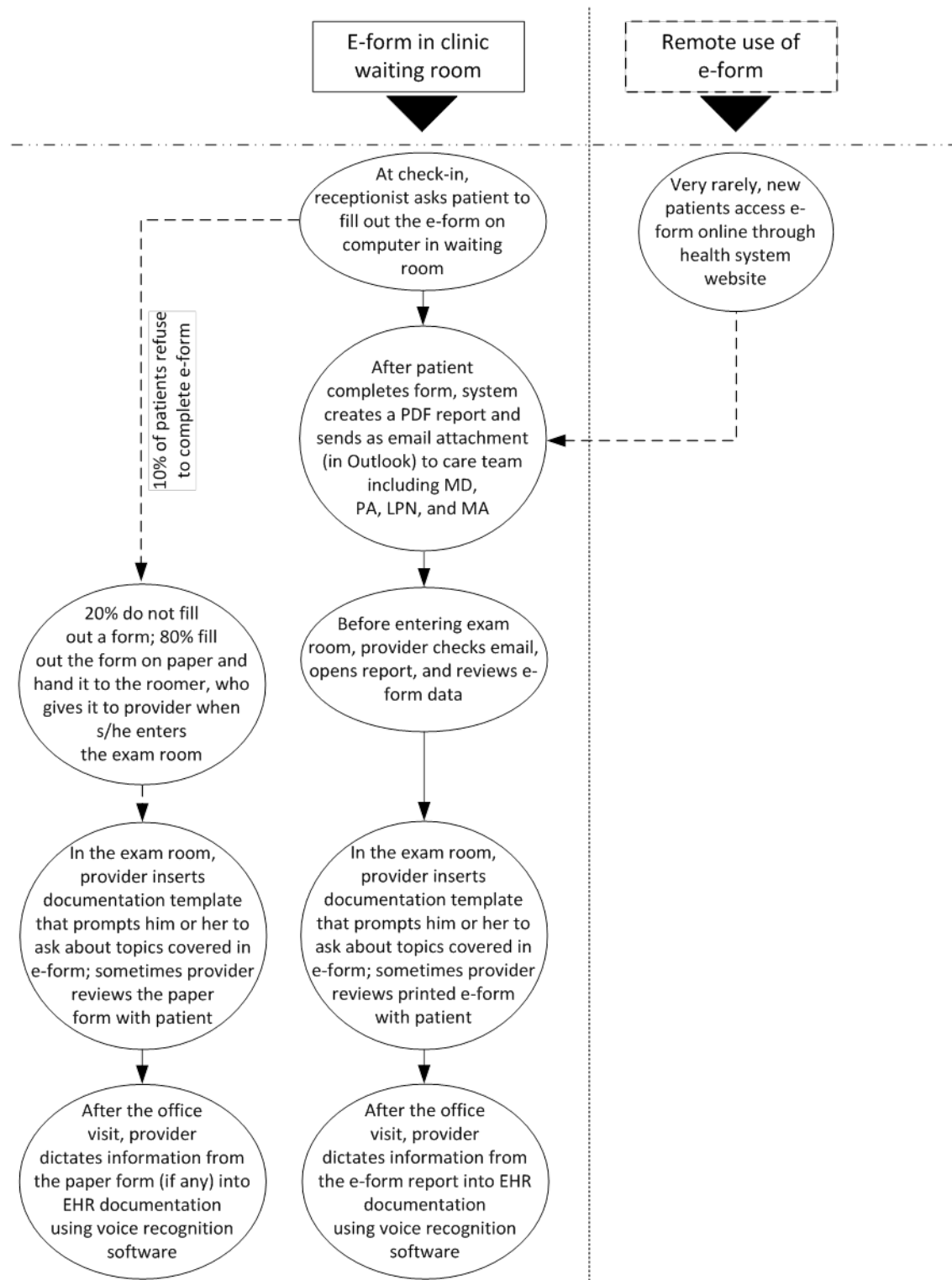
4.2.1.1. Clinic 1: Migraine e-form. In Clinic 1, the migraine e-form was implemented nearly three years before study data were collected. The e-form is administered by the Instant Medical History (IMH) software,^{56,57} and the questionnaire is a standardized headache consult form based on a combination of existing questionnaires: the Patient health Questionnaire,⁵⁸ the Migraine Disability Assessment (MIDAS),^{59, 60} and the Migraine Treatment Optimization Questionnaire.⁶¹ At check-in, reception staff direct the patient to fill out the e-form on a computer workstation in the waiting room. If the patient needs help completing the e-form, a receptionist assists the patient. Several times a week, the e-form system “freezes” and must be rebooted before the patient can complete the e-form. Some patients access the e-form using a link on the health system Web site and complete the form outside of the clinic, prior to their appointment. If they have done so, they tell the receptionist at check-in that they have already completed the form.

The form usually takes 5–10 minutes to complete, but some patients take much longer. The e-form contains questions about employment, missed work, medications, self-care, depression, and domestic abuse. After the patient submits the e-form, the e-form software automatically emails a summary report to the care team in a password-protected PDF file. From this point, the workflow is different for new patients (see Figure 12) and returning patients (see Figure 13).

For new patients, the provider reviews the emailed report and sometimes brings a printed copy into the exam room. The provider inserts a template into the office visit documentation that

serves as a reminder to talk with the patient about specific topics. After the office visit, the provider uses speech recognition software to dictate the information from the e-form into the office visit EHR documentation. Providers would prefer to copy text from the report and paste it into the documentation (instead of using the template), but the current format of the report and software do not permit this. Only the report for returning patients has been restructured by the vendor so that it can be easily copied into the EHR documentation. The provider has requested that the vendor also modify the longer report for new patients, but the vendor is unwilling to invest time in restructuring the report unless more providers request this change.

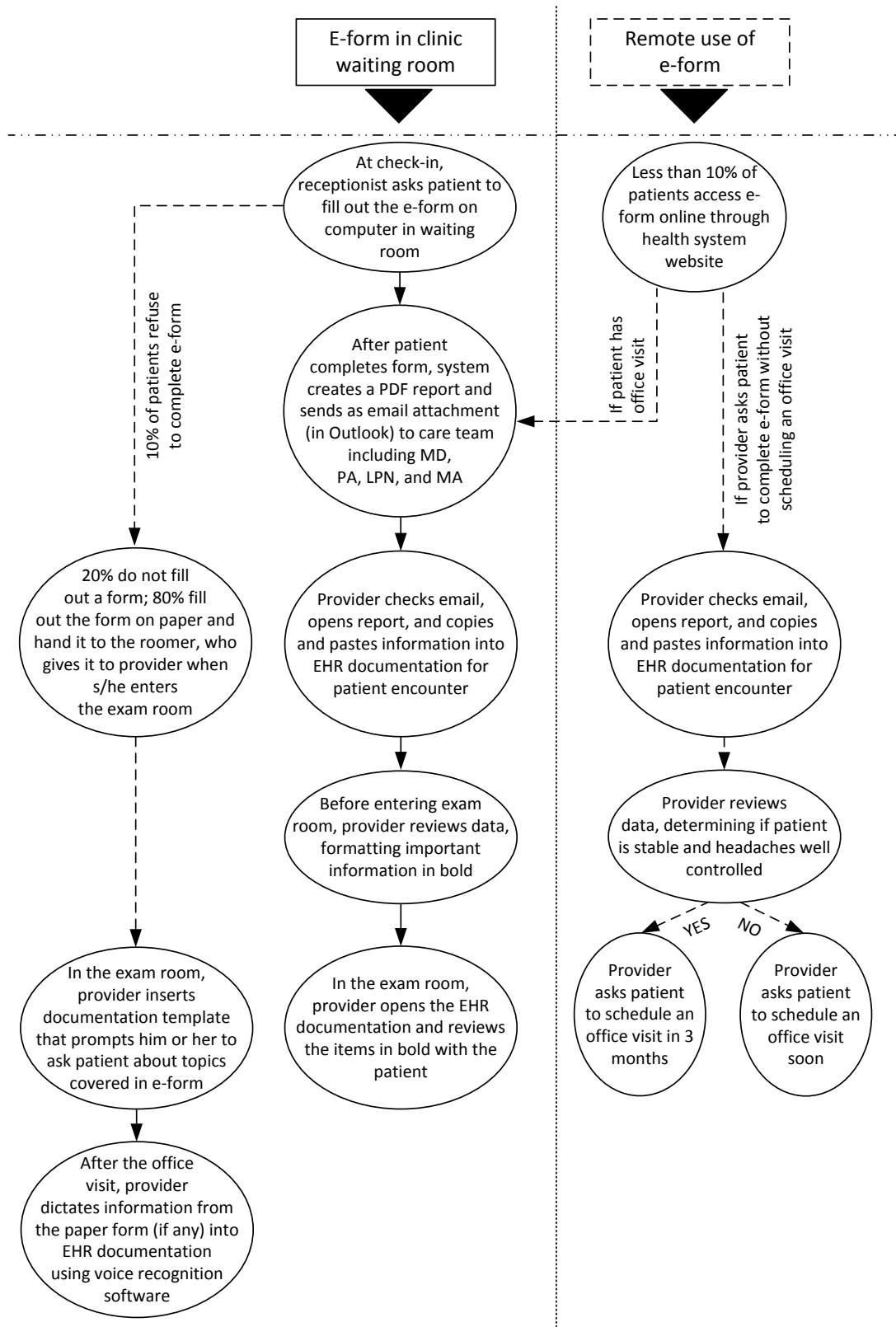
Figure 12. Migraine e-form workflow for new patients at Clinic 1



For returning patients, the provider opens the summary report attached to the email before entering the exam room. The provider copies and pastes information out of the report and into the EHR documentation for the office visit, then reviews the data and uses bold text to indicate information that should be discussed with the patient. The provider pulls up the documentation in the exam room and reviews the e-form data with the patient, focusing on the sections in bold.

For some patients, the provider uses the e-form in lieu of a followup office visit. For most headache patients, he schedules followup office visits every three months. However, for patients with stable headaches that are well managed by the current care plan, he asks them to complete the e-form online three months after an office visit. When the patient submits the e-form, the provider reviews the data to see whether the patient is still stable. If so, he asks the patient to make an appointment three months later. If not, he has the patient make an appointment to come into the clinic immediately.

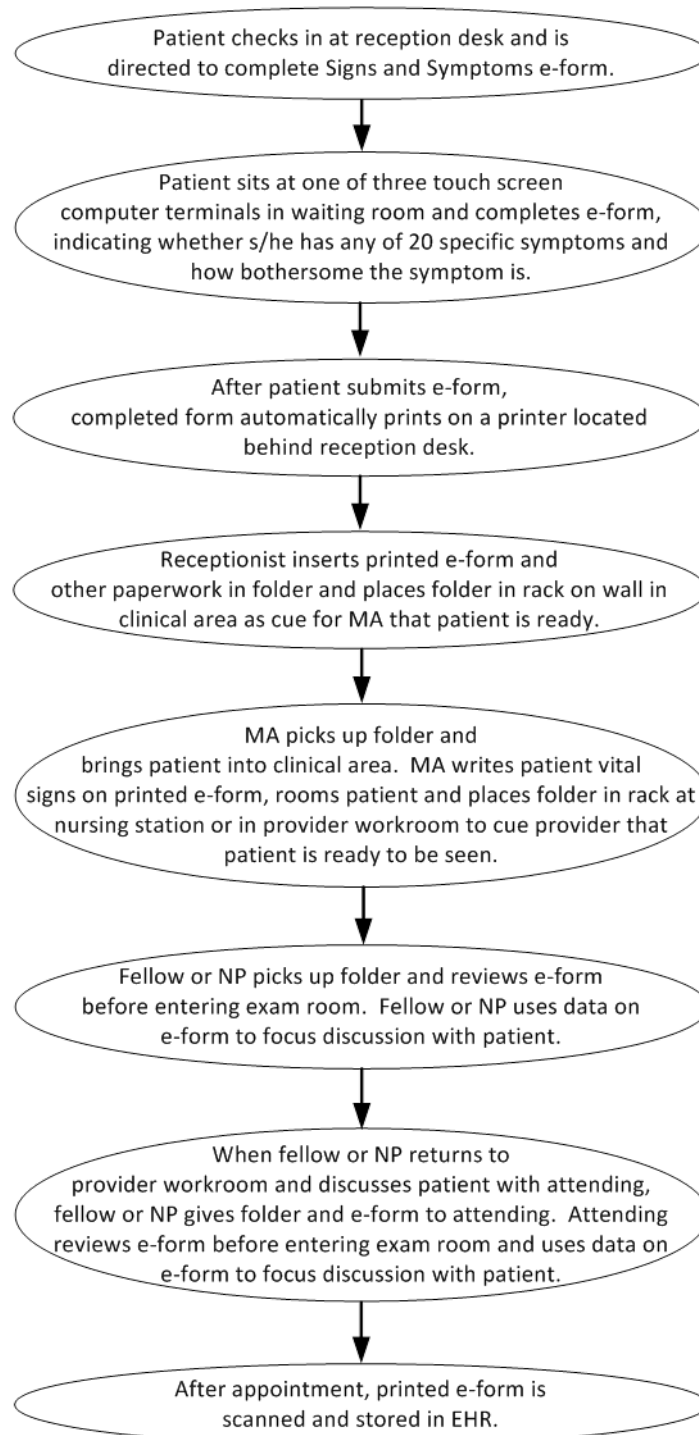
Figure 13. Migraine e-form workflow for returning patients at Clinic 1



If a new or returning patient refuses to complete the e-form, s/he is asked to complete the paper version. The paper form is collected by the MA, who gives it to the provider right before s/he enters the exam room. After the office visit, the provider uses speech recognition software to dictate the information from the paper form into EHR documentation for the office visit.

4.2.1.2. Clinic 4: Signs and symptoms e-form. Clinic 4 uses two e-forms, both of which were implemented 6 years before study data collection. Patients fill out the S&S e-form in the waiting room prior to each appointment (see Figure 14 for a process map describing the workflow). At check-in, a receptionist asks the patient to complete the S&S e-form on one of three touch screen computer terminals in the waiting room. If the patient has trouble using the system, a volunteer “clinic host” is often available to help, otherwise, receptionists are responsible for assisting the patient. The S&S e-form lists 20 symptoms (e.g., “Nausea/Vomiting”) and the patient clicks a radio button to indicate whether s/he has this symptom and how much it “bothers” him/her. (See Appendix V for screen shots of the e-form.) This form takes 1–5 minutes to complete. After the patient submits the e-form, it prints automatically on a printer located behind the reception desk; all items that “bother” the patient “some” or “a lot” are printed in bold type. When the form is printed, the receptionist knows that the patient is ready to enter the exam room. The printed copy of the e-form is placed in a folder with other paperwork and placed in a rack on the wall inside the clinical area. The MA collects the folder, calls the patient in and hand-writes information about the patient’s vital signs and smoking status on the printed form. After the patient is in the exam room, the MA places the folder in a rack at the nursing station (for one part of the clinic) or in the provider workroom (for the other part of the clinic). Presence of the folder is a cue to the provider that the patient is ready to see the primary care provider (PCP). PCPs in this clinic are physician fellows or NPs who are supervised by an attending physician. The PCP enters the exam room, assesses the patient, and returns to the provider workroom to propose a plan of care to the attending physician. After the PCP and attending have agreed on a proposed plan of care and the PCP has shared it with the patient, the attending enters the exam room and conducts a separate assessment of the patient. Both the PCP and the attending bring the printed e-form into the exam room and focus on the symptoms in bold when talking with the patient. After the office visit, the printed e-form is signed by the PCP and attending, scanned and stored as a PDF document attachment in the EHR.

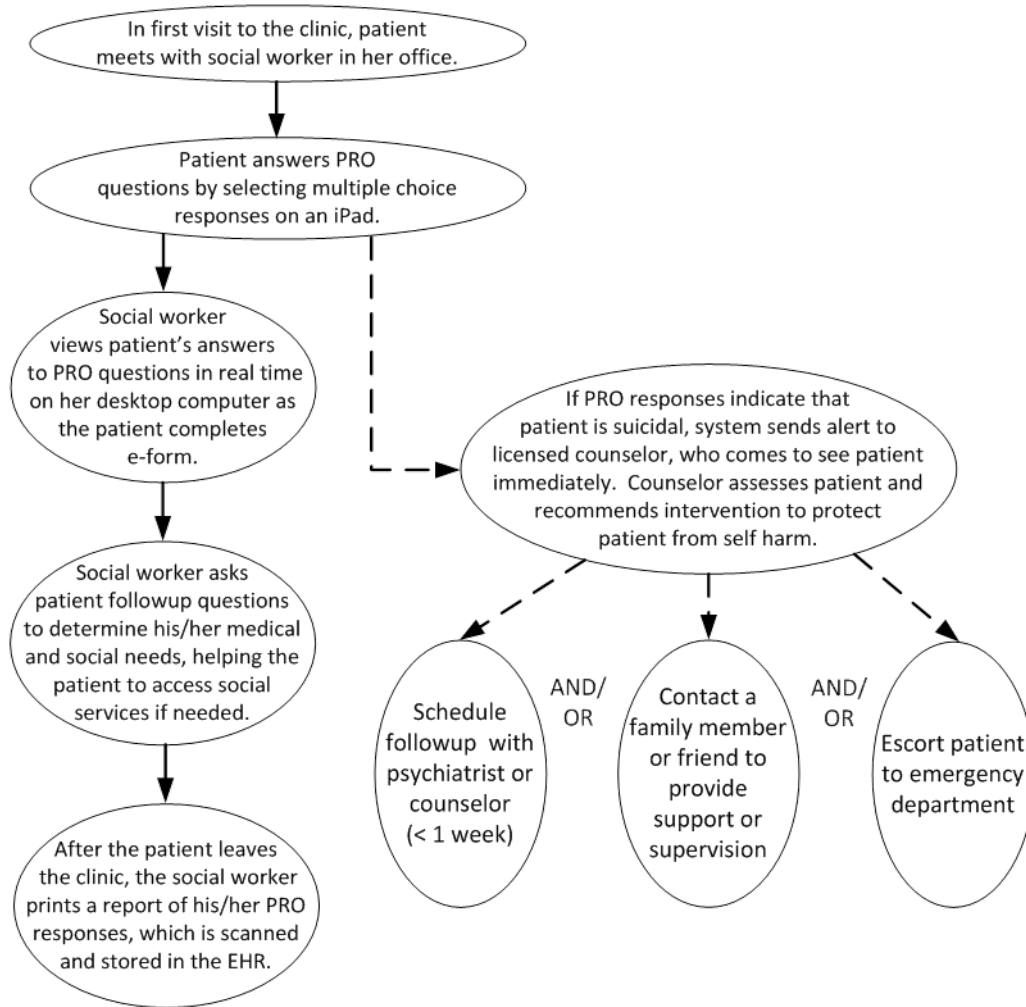
Figure 14. Signs and Symptoms e-form workflow at Clinic 4



The signs and symptoms data are also stored in a patient database with other medical information on each patient. Prior to implementation of the e-form, patients completed the form on paper in the waiting room. Patients who decline to complete the form electronically are still given a paper form to complete instead, as are patients who arrive at the clinic when the S&S e-form is temporarily down.

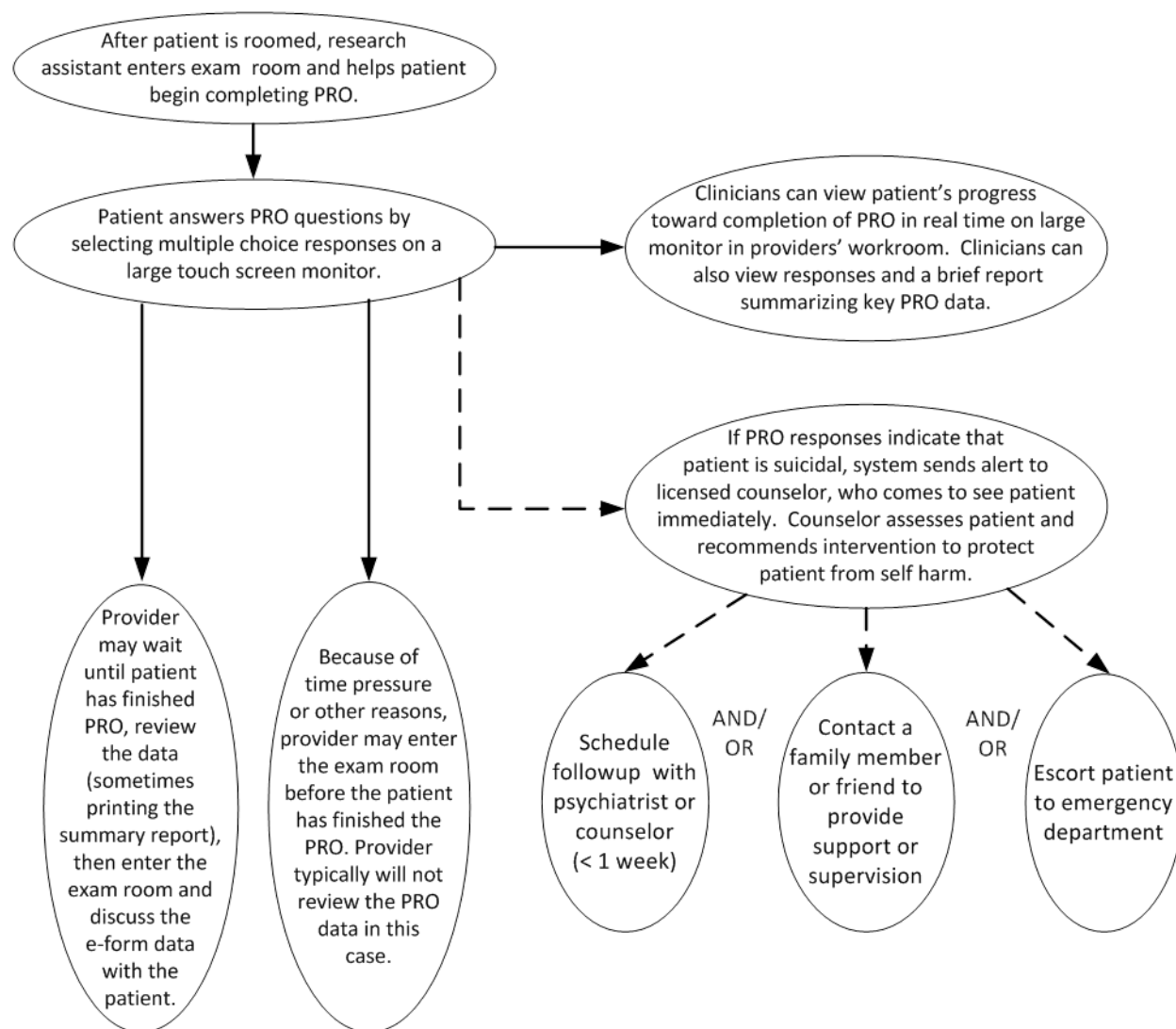
4.2.1.3. Clinic 4: Patient-reported outcomes e-form. The second e-form in use in Clinic 4 is the patient-reported outcomes (PRO) form (see Appendix W for screen shots of the form). The PRO system was implemented as part of a large national study⁶²⁻⁶⁴ conducted by the Center for AIDS Research Network of Integrated Clinical Systems (CNICS). The PRO e-form includes validated questionnaire scales on depression (PHQ-9); anxiety (PHQ anxiety module); alcohol risk (AUDIT-C); substance abuse (ASSIST); and anti-retroviral medication adherence (ACTU-4). In their first visit to the clinic, patients fill out the PRO e-form in a meeting with a social worker (see Figure 15 for a workflow process map). The social worker begins the meeting by asking the patient demographic questions and then helps the patient to begin completing the PRO on an iPad. Completing the PRO e-form takes about 10–15 minutes. Data from the PRO are available in real time, which is not true of the other e-forms. After each question is answered, the response can be reviewed by the social worker, clinic providers, and research staff, both locally and at the CNICS research office at the University of Washington. As the patient completes the e-form, the social worker reviews the responses using a desktop computer logged in to the PRO administrative system. When the patient has finished the e-form, the social worker discusses some responses with the patient, assessing the patient's medical and social needs. The social worker also helps to connect the patients with social services, if needed.

Figure 15. Patient-reported outcomes e-form workflow for new patients at Clinic 4



In later visits to the clinic, patients are asked to complete the PRO on touch screen computer terminals in the exam room every 4–6 months (see Figure 16). After the patient has been brought into the exam room by an MA and the MA has left, a CNICS research assistant enters the exam room to complete the consent process and confirm that the patient consents to participate in the study. If the patient agrees to participate, the research assistant asks the patient to complete the PRO, giving the patient a four-digit code that s/he uses to log in to the PRO system. The research assistant also helps any patients that need assistance in starting the PRO or completing the form. While the patient is completing the e-form, providers can and frequently do monitor a patient's progress in real time on video monitors in the provider workroom. A one-page report summarizes key PRO data for each patient, including depression, suicidal ideation, substance abuse, tobacco use, alcohol consumption, anti-retroviral adherence, and high-risk sexual behavior (see Appendix X for an example summary report). Clinicians can view this summary in real time, reviewing information entered up to the current moment.

Figure 16. Patient-reported outcomes e-form workflow for returning patients at Clinic 4



PRO data are also used to trigger interventions. If a patient reports having frequent and serious suicidal thoughts, a licensed counselor receives an alert and immediately goes to the patient in the exam room. The counselor assesses the patient and proposes an intervention to the provider, which may include scheduling an appointment with a psychiatrist or counselor within the next week, contacting a family member or friend to provide support or supervision, and/or escorting the patient to the emergency department if needed. The intervention is discussed with the patient and implemented.

Use of the PRO data varies across providers. Some try to wait for patients to complete the PRO before entering the exam room, then open the PRO data on the monitor in the exam room (or print the summary and bring it into the exam room) and discuss the e-form data with the patient. Other providers do not typically wait, but use the PRO data if it is available and proceed without it if the patient has not yet finished completing the form when the provider is ready to conduct the exam.

Because the PRO is part of a research study, only patients who have consented to participate complete the form. Of approximately 3,000 clinic patients, around 2,650 patients are currently

enrolled in the PRO study, and nearly 300 have withdrawn. Patients are asked to complete the PRO on their first visit to the clinic and every 4–6 months afterward during clinic visits. Patients occasionally decline to complete the form at a specific visit, such as when they are feeling very ill. In this case they are asked to complete the PRO at the next clinic visit.

PRO data are not integrated into the EHR, with a few exceptions. A report summarizing data from the first patient visit to the clinic is scanned and saved in the EHR by social work staff. Also, some providers habitually document PRO data in their EHR notes. Although providers have the ability to pull up PRO data on the monitors in the providers' workrooms, including patients' responses that were submitted in prior visits, many of the providers we interviewed are unaware of this fact or do not know how to access the data.

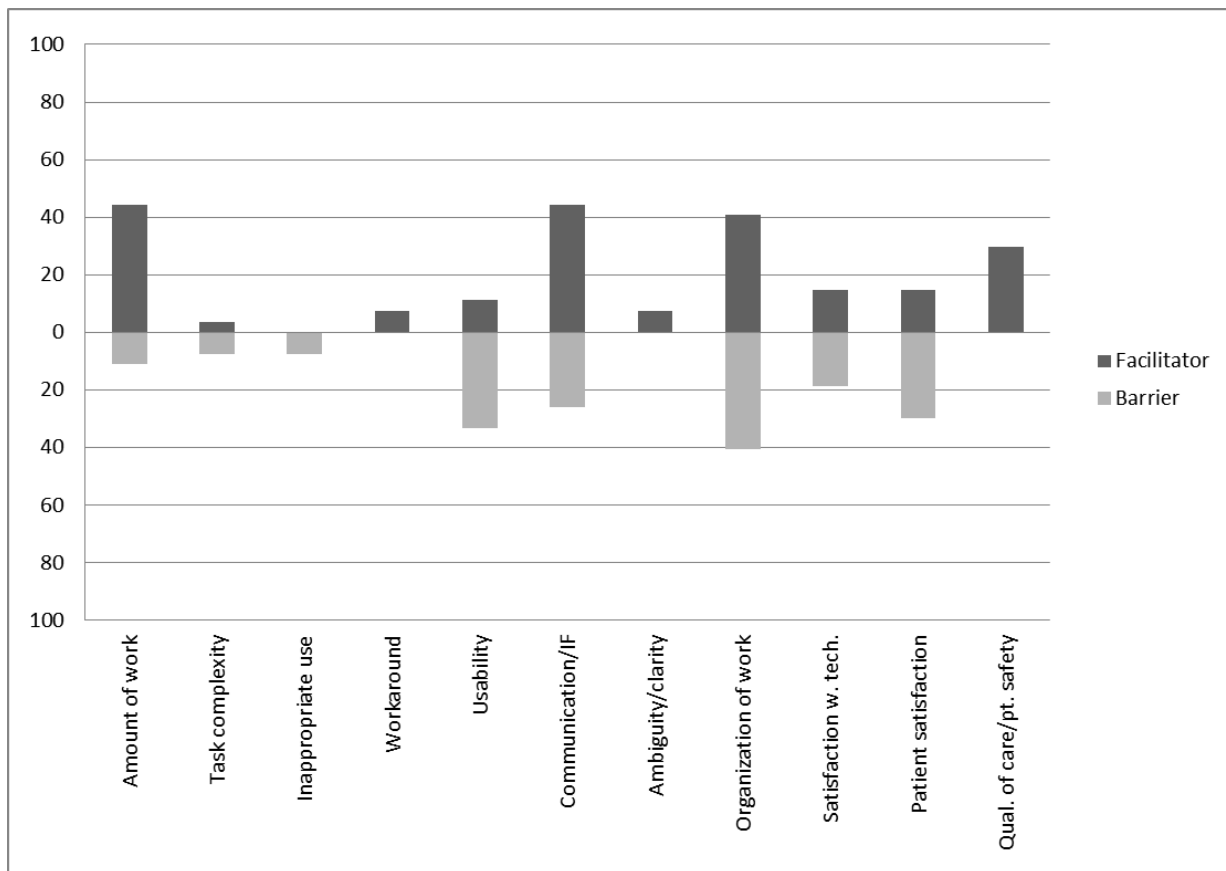
4.2.2 Research question 1: Facilitators and Barriers to the Use of e-forms

4.2.2.1. Facilitators and barriers to the use of e-forms identified by clinicians. For the three e-forms, we coded data on facilitators and barriers to workflow. For Clinic 1, we coded data from concurrent interviews and observations of the physician, PA, and RN who use the migraine e-form (three interviews in total). For Clinic 4, we coded data on facilitators and barriers to S&S workflow identified in concurrent interviews and observations of six physicians, four NPs, and two RNs (12 interviews in total). Also for Clinic 4, we considered the same 12 concurrent interviews and observations to be “separate” interviews for the sake of analyzing data on facilitators and barriers to the PRO workflow.[‡]

We therefore could identify facilitators and barriers related to each dimension for a maximum of 27 clinician interviews. Figure 17 shows the percentage of the 27 interviews in which facilitators and barriers were identified for each dimension.

[‡] Note that the workflows for the two e-forms at Clinic 4 were so different that interview subjects nearly always described facilitators and barriers to either the S&S or the PRO. On the rare occasions when an interviewee did not specify which e-form was being discussed, the interviewers asked clarifying questions.

Figure 17. Facilitators and barriers to the use of e-forms identified in clinician interviews (N=27)



Clinicians most often identified facilitators related to communication, amount of work, organization of work, and quality of care and patient safety. Barriers were most often related to the organization of work, usability, communication, and patient satisfaction. Table 22 shows the number of interviews in which facilitators and barriers related to each dimension were mentioned by interviewees. Overall, clinicians identified facilitators in slightly more dimensions (an average of 2.9 per interview) than barriers (an average of 2.3).

Table 22. Facilitators and barriers to the use of e-forms identified in clinician interviews (N=27)

Dimension	Facilitator	Barrier
Amount of work	12	3
Task complexity/simplicity	1	2
Inappropriate use	NA	2
Workaround	2	NA
Usability	3	9
Communication/information flow	12	7
Ambiguity/clarity	2	0
Organization of work	11	11
Satisfaction with technology	4	5
Patient satisfaction	4	8
Quality of care/patient safety	8	0
Mean dimensions per interview (SD)	2.9 (1.74)	2.3 (1.38)

4.2.2.1.1. Communication and information flow. Many clinicians identified facilitators related to communication and information flow. For example, several providers described how important topics covered by e-form questions allow them to learn more about the patient and his or her health.

I can focus on the patient in the room and ... make sure that I've asked all these salient questions regardless of whether I'm tired or the patient's distracted. So it makes me more comprehensive. I do ferret out things that I wouldn't have ferreted out in the past, like their husband is beating them or they're drinking too much, or they want more information about stress, or they're sleeping poorly, or they're angry with me. (Clinic 1 Physician)

One provider at Clinic 4 said that use of the S&S e-form allowed him to relax, because he no longer had the stress of trying to collect so much information in a short visit. This allowed him to communicate better with the patient.

Another provider at Clinic 4 appreciated the large amount of information collected through use of the PRO at the patient's first visit to the clinic. The PRO e-form gave him information about the patient's history, barriers to receiving care, and other background information so that the provider can "go in [to the exam room] with an idea of who this person is" (Clinic 4 Physician). The provider felt this helped him communicate and build rapport with the patient.

Nearly every provider at Clinic 4 mentioned that their patients are more honest when answering questions on the e-forms than when answering the same question face-to-face. Clinic researchers verified this fact in a study. Because the clinic's population of HIV-positive patients requires providers to address sensitive issues such as mental health, sexual behavior, illegal drug use, alcohol abuse, and medication adherence in nearly every visit, all providers explained that the e-forms are helpful in uncovering the truth about a patient's health and behavior.

The PRO can give us a lot of valuable information, because [it] asks the question over and over again and may dig up alcohol overuse or med nonadherence or not using condoms and things like that. But we won't be able to find out if we ask [patients] point blank, because they don't want to tell us then. For those kind of things—substance use, safety with sex, taking your medicines—people tend to want to make their provider happy by telling them what they want to hear. (Clinic 4 NP)

Also, several providers reported that the use of the PRO e-form in the exam room helps in sharing information with patients, such as trends in patient responses that can indicate the need for a specific type of treatment.

It's nice if you have a patient and you can show them this is your PHQ-9, which tells us about your depression. And you see how high it is today? It's 27. Last time it was 14, and the time before that it was only 7. So it's pretty obvious, you know, you're getting more and more depressed. That's a pretty cool feature that you can do with the patient in the room. (Clinic 4, Clinic director)

Many providers also described communication barriers related to the e-forms at Clinic 4. One is related to the accuracy of patients' responses. Some patients click responses at random, either because of low health literacy or because they do not want to take the time to fill the form out correctly.

I've seen patients [complete the PRO] when I'm in the room; they're not paying any attention to it and [are] just entering information to get through it. ... In cases where I actually see a disconnect, for example, they say, I'm 100 percent adherent, and [I can tell] they're not, then we talk about it. (Clinic 4 Physician)

A related barrier is that the provider may place too much trust in the accuracy of the e-form data and use that information to structure the office visit. One provider commented that this could "close up the conversation" (Clinic 4 Physician) and discourage the provider from letting the patient describe his/her concerns. One NP reviews the e-form data with the patient because she believes the accuracy of information is better if topics are discussed with the patient.

4.2.2.1.2. Amount of work. Nearly all providers who work with e-form data described how the e-forms saved them time. Providers reported that e-forms address many questions that the providers would otherwise ask patients verbally, reducing workload in the exam room: "It honestly feels like I walk into the room, and somebody is saying, hey, I know you're having a busy day, here's a gift of 10 minutes. That's what a PRO feels like" (Clinic 4 Physician). One provider noted that asking patients questions directly often leads to a discussion of each item and extends the visit. Providers at both clinics reported that e-forms allowed them to focus on the most serious health problems and to more thoroughly discuss issues of concern to the patient in the exam room.

The e-forms were also found to reduce documentation time at Clinic 1. A provider conducted a time study on the use of the migraine e-form in clinic 1 for both new and returning patients, and found that it reduced his documentation time substantially. For returning patients, the two providers who use the e-form application are able to copy and paste information out of the e-form report, review the patient's responses, and add bold type to key points in approximately 20 seconds per patient on average. Dictating the same information into a documentation template using speech recognition software takes about 90 seconds on average. For this reason, one of the providers has been strongly encouraging the vendor of the e-form software to reformat the report for new patients so that the provider would also be able to also copy and paste the information from that report into documentation, but the vendor is unwilling to do so for a small group of users. The provider currently spends 7–8 minutes dictating the e-form data for each new patient into EHR documentation.

4.2.2.1.3. Organization of work. One facilitator identified by providers is that both the S&S and the migraine e-form standardize office visits, by ensuring that the same questions are asked—

in the e-forms—and later addressed in the exam room if needed. The provider is able to focus the discussion in the exam room on the problems that are bothering the patient most (e.g., pain) and the e-form responses that are of most concern to the provider (e.g., excessive alcohol use). Providers also reported that the S&S and migraine e-forms can make visits more efficient. Patients are able to complete the e-form in a few minutes in the waiting room so that moving the patient to the exam room is not delayed. Use of the e-form was described as speeding up the encounter in the exam room.

It makes the visit more efficient, and I have more information before I walk in the door. So it seems to prevent the, oh, by the way, as I am walking out the room. ... I know what their agenda is.
(Clinic 4 Physician)

Use of the migraine e-form as an informal “e-visit” is also a facilitator. It allows the provider in Clinic 1 to include many more headache patients into his patient panel. As described earlier, patients who are stable and whose headaches are well controlled can complete the e-form three months later instead of scheduling a followup in-person visit to the clinic. This use of the e-form frees up office visit time for additional patients.

Many Clinic 4 providers reported that the PRO takes time for patients to complete in the exam room, forcing the providers to either wait until the patient finishes or enter the exam room without reviewing the data. Because e-form workflow is generally a serial process in which patients must finish completing the form before clinicians can begin evaluating and treating the patient, the PRO is more problematic than the other two e-forms: it is completed in the exam room instead of in the waiting room. Providers find it difficult to choose between prioritizing the efficiency of the clinic (entering the exam room whether the patient has finished the form or not) and waiting for information that can be helpful in treating the patient, which is perceived as slowing the flow of patients through the clinic. Breakdowns and usability issues with the computer terminals in the exam rooms exacerbate this problem.

We’re kind of chomping at the bit to get in [the exam room] to see them, but I generally want them to fill [the PRO] out before I go in and see them. So then it’s like sit and wait and look at the screen and wait for the ... little blue bar to go all the way across. Because I think [the PRO information is] helpful.
(Clinic 4 Physician Leader)

A barrier in Clinic 1 is that both the physician and the PA in the care team that uses the e-form may begin copying and pasting the e-form report data into the patient record at the same time. This happens rarely, and they usually realize what is happening quickly. However, this duplication of work can cause confusion.

4.2.2.1.4. Usability. Usability barriers for clinicians include the fact that the e-forms do not automatically transfer data to the clinic EHR. Each system has different usability issues related to data storage and access. Data from the migraine e-form is relatively accessible because it is copied or dictated into the office visit EHR documentation. However, readability of the report created from the migraine e-form data is a barrier. The e-form has a branching structure, so that answering “yes” to a screening question opens a group of additional questions on that topic. A patient who answers “yes” to many of the screening questions will have a long report that is difficult to review or copy quickly. Also, some sections of the report are jumbled with unrelated sections, because of a flaw in the design of the e-form report, so the provider must edit the report before copying and pasting it.

For the S&S e-form, a printed copy is scanned and stored as an attachment to the patient's medical record in the EHR after the office visit. Access to these data can be difficult because scanned documents cannot be searched and clinicians need to know where to find the scanned forms.

What I'll do is I'll reference in the review of systems, please see white sheet [the printed S&S e-form], and then that white sheet is kept and ... I incorporate it into the record. But, unfortunately, for somebody else looking at the EMR, they aren't going to exactly be able to see what that is without coming over to the clinic or requesting that sheet. (Clinic 4 Physician)

Information from the PRO for the first patient appointment is scanned into the EHR, but the data for returning patients is only recorded in the EHR if the provider chooses to type it in as part of the note. Several providers were frustrated by their inability to easily review the PRO data, particularly trends over time.

Other usability barriers are related to the computer hardware. Clinicians reported that the PRO touch screens are difficult for both patients and providers to use. The S&S workstations in the Clinic 4 waiting room often require rebooting and break down frequently. The workstation used for the migraine e-form at Clinic 1 frequently freezes and requires rebooting. In this situation, patient data are not saved and the patient must start entering the e-form again from the beginning.

4.2.2.1.5. Perceived outcomes. Both facilitators and barriers related to perceived outcomes were identified. One facilitator is related to quality of care. According to an NP at Clinic 4, the S&S e-form improves quality of care by ensuring that patients receive a more comprehensive evaluation and do not forget to mention important health issues to their PCP. Several other Clinic 4 providers report that the suicide and domestic violence interventions are very important for quality of care because they ensure that patients are assessed for depression and domestic abuse, and interventions are implemented if needed.

We have actually had several [patients] commit suicide. And that's devastating to that individual, clearly, and their family. And it also reverberates within the clinic. ... You go back and you look, and that conversation never even came up, and you always start second guessing yourself. ... [Now we have] addressed in a very methodical, protocolized way how we were going to make the assessment and how we were going to deal with it when we found the problem. (Clinic 4 NP)

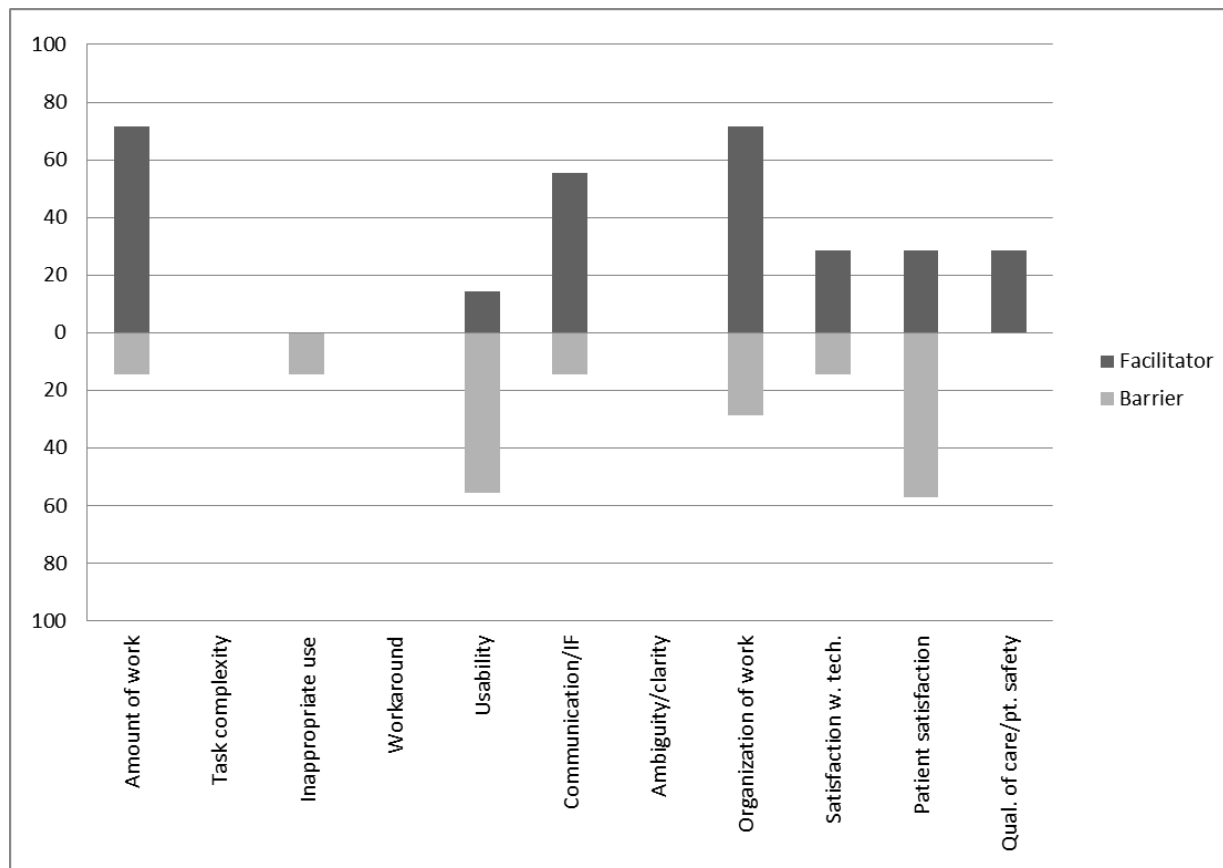
A barrier, primarily for the S&S and PRO e-forms, is patient satisfaction. Some patients do not want to use the e-forms.

One [patient complaint] has been that I don't want my information out there [in a computer]. Another one is I don't want to spend the time doing it, that's kind of a common one. I just don't have time for this, [but] they're sitting there anyway. ... The other one often is I just don't want to be a guinea pig for another research study. Even though it's not necessarily only for that, this sometimes is the perception. (Clinic 4 Physician)

Other patients become tired of completing the e-forms because the same questions are being repeated. Patients often want to stop using the e-forms. Consequently, providers must spend time talking with patients about the value of the e-forms for patient care: "It takes some investment on the part of the provider to keep patients engaged and understanding the relevance [of the e-forms]" (Clinic 4 NP).

4.2.2.2. Facilitators and barriers to the use of e-forms identified by clinic staff. Data from nonclinician staff about e-forms includes interview and observation data for one Clinic 1 MA who works with the migraine e-form; concurrent interview and observation data for two receptionists and two MAs who work with the S&S e-form at Clinic 4; and concurrent interview and observation data for two social workers who use the PRO e-form at Clinic 4. Figure 18 shows the percentage of these seven staff interviews in which facilitators or barriers related to each dimension were identified.

Figure 18. Facilitators and barriers to the use of e-forms identified in staff interviews (N=7)



Facilitators identified by staff most frequently relate to communication, organization of work, and amount of work. Barriers most often relate to usability, patient satisfaction, and the organization of work. As can be seen in Table 23, staff identified facilitators in more dimensions (an average of 2.7 per interview) than barriers (2.1 per interview).

Table 23. Facilitators and barriers to the use of e-forms identified in staff interviews (N=7)

Dimension	Facilitator	Barrier
Amount of work	5	1
Task complexity/simplicity	0	0
Inappropriate use	NA	1
Workaround	0	NA
Usability	2	7
Communication/information flow	5	1
Ambiguity/clarity	0	0
Organization of work	5	2
Satisfaction with technology	2	1
Patient satisfaction	2	4
Quality of care/patient safety	2	0
Mean dimensions per interview (SD)	3.4 (1.68)	2.1 (1.81)

4.2.2.2.1. Communication and information flow. Staff identified several facilitators related to communication. For example, both MAs at Clinic 4 stated that patients are able to share information more easily with the e-form than in talking face-to-face with providers.

A lot of patients, for some reason doctors make [them] nervous. ... But, you can just answer those questions on the computer. And that way they know, and you don't have to get uncomfortable, anxious where you forget what you wanted to tell them. (Clinic 4 MA)

Staff also reported that patients are more truthful in their responses to an e-form than they are in person.

Social workers at Clinic 4 appreciated the in-depth knowledge that is collected on the PRO at a new patient's first visit.

It's really useful when we're just getting to know somebody. ... I've never met you, so I don't know exactly where you are. If you're newly diagnosed, and you're going to be on my caseload, I want to know exactly how you feel. ... What's your history as far as substance abuse? Because our questionnaires include those kinds of answers so that I know, when we meet, are we going to be trying to find you housing ... Is your substance abuse a problem as far as how you feel with suicide? It's really helpful. (Clinic 4 Social worker)

MAs and receptionists preferred the e-forms to paper forms because handwritten forms can be difficult to read or may have multiple answers to a single question that are hard to interpret. Also, Clinic 4 receptionists reported that the paper S&S form has a confusing format with English and Spanish sections. This is not the case for the S&S e-form; therefore, responses on the e-form are more likely to be accurate.

4.2.2.2.2. Organization of work. Clinic 4 receptionists and social workers identified facilitators related to the organization of work. Clinic 4 receptionists strongly prefer the S&S e-form to having patients complete the S&S form on paper. They appreciate the efficiency of having the S&S form automatically printed on a printer behind the reception desk. In contrast, the paper form—which is still used when the S&S e-form is not working—is less efficient because reception staff were required to hand out paper S&S forms to patients on clipboards and help them to complete the forms if needed: “[Paper was] definitely slower. And especially when you

have a lot of patients and you run out of clipboards, you run out of pens, that kind of deal. So it caused a little bit of commotion” (Clinic 4 Receptionist).

Similarly, social workers at Clinic 4 prefer the workflow using the PRO e-form for a patient’s first visit to the clinic. They are able to review the patient data and automatically calculate scores on questionnaire scale data (such as substance abuse and depression) while the patient is completing the rest of the e-form.

It’s more immediate. ... Even as he is taking it I can go in and see his answers and already know what to address with the patient. ... At the end of the interview, we already know what his needs are. Whereas before, with the paper form, I would have to just look at it and get an idea. ... That’s not a real good way to do it, guess work. (Clinic 4 Social worker)

Additionally, with the paper form, the social worker calculates the scores by hand, but only after the patient has left the clinic. Sometimes she needs to ask the patient to come back in if the scores indicate that the patient needs immediate care, such as counseling for substance abuse.

One barrier related to organization of work was reported by receptionists at Clinic 4. When no clinic volunteers are in the waiting room to help patients, receptionists are responsible for assisting patients to complete the S&S e-form. They reported that they are sometimes overburdened when trying to help patients while many others are checking in for appointments. The time invested in helping patients with language or literacy barriers can be substantial.

INTERVIEWER: If a patient is having trouble with literacy, you read the questions out loud to them, and then do you answer for them, or do you help them push the buttons?

RECEPTIONIST: I’ll answer for them to start with, and I’ll see if they’re okay with it. And if they’re not, I’ll have to continue to do it. (Clinic 4 Receptionist)

4.2.2.2.3. Amount of work. Nearly all staff mentioned that e-forms reduce their workload because they are no longer required to distribute and collect paper forms, decipher difficult handwriting, and, for Clinic 4 social workers, calculate questionnaire scale scores by hand. Prior to implementation of the S&S e-form on workstations in the waiting room, the MAs for Clinic 4 were also required to help patients complete the S&S before showing them to an exam room. They therefore reported that the e-form saves them a substantial amount of time.

4.2.2.2.4. Usability. A usability issue for the migraine e-form is related to the skip pattern of questions. If a patient clicks the wrong answer to a screening question, a series of new questions may open that do not apply. Staff must then explain how to go back and correct the error.

Staff identified several usability barriers related to the use of e-forms. One usability barrier at Clinic 4 is that the touch screens can be difficult to use. Staff must help patients learn how to touch the screen correctly, which can be difficult. The touch screen aspect, it’s good in theory, but a lot of people have a lot of problems with it. It’s not always accurate where they push it, where they’re using their fingernails. ... You’ll hear people over there just [trying to fill out the form] and it’s not taking, not registering. Or there will be people scratching with their fingernails but you really just have to have ... a light finger touch to it, and that’s kind of difficult. How do you explain that to somebody? (Clinic 4 Receptionist)

So a lot of times people will say that doesn't pertain to me, or I had something wrong, and then a whole new set of 20 questions come up. ... So, for example, if you hit you drink more than four [drinks of] alcohol, whatever the number is, then a whole other set of questions comes up. It just kind of compounds. (Clinic 1 MA)

Other usability barriers are specific to the S&S e-form. New patients are sometimes not able to use the S&S e-form because they have not been entered into the database yet. Receptionists are ordinarily able to enter patient information and give the patient access to the system, but sometimes the system will not accept the information entered by the receptionist. Receptionists contact IT staff on site for help, but the problem can rarely be solved in time for the patient to complete the e-form. Another usability barrier with the S&S e-form is that the terminals often require rebooting and break down frequently. IT staff can reboot a machine within an hour, but repairs take longer. Also, the system frequently goes down for short periods. Each time this happens the reception staff use paper forms until it is working again. Another barrier is that the S&S can be completed in Spanish but most patients do not know about that possibility or how to access the Spanish version of the e-form.

Another usability barrier was reported by social workers who have patients complete the PRO on iPads during their first visit. The iPad has two icons for the PRO, one that takes the patient to the correct app for completing the PRO and another that takes the patient into an administrative system where they could complete the PRO but could also see the data for all the other patients who have taken the PRO, including patient names. The social worker who reported this barrier was concerned about confidentiality but said that the problem has not yet been corrected.

4.2.2.2.5. Perceived outcomes. Other barriers are related to patient satisfaction. Staff at Clinic 4 reported that patients resist completing the e-forms, particularly the S&S, if they have been visiting the clinic often.

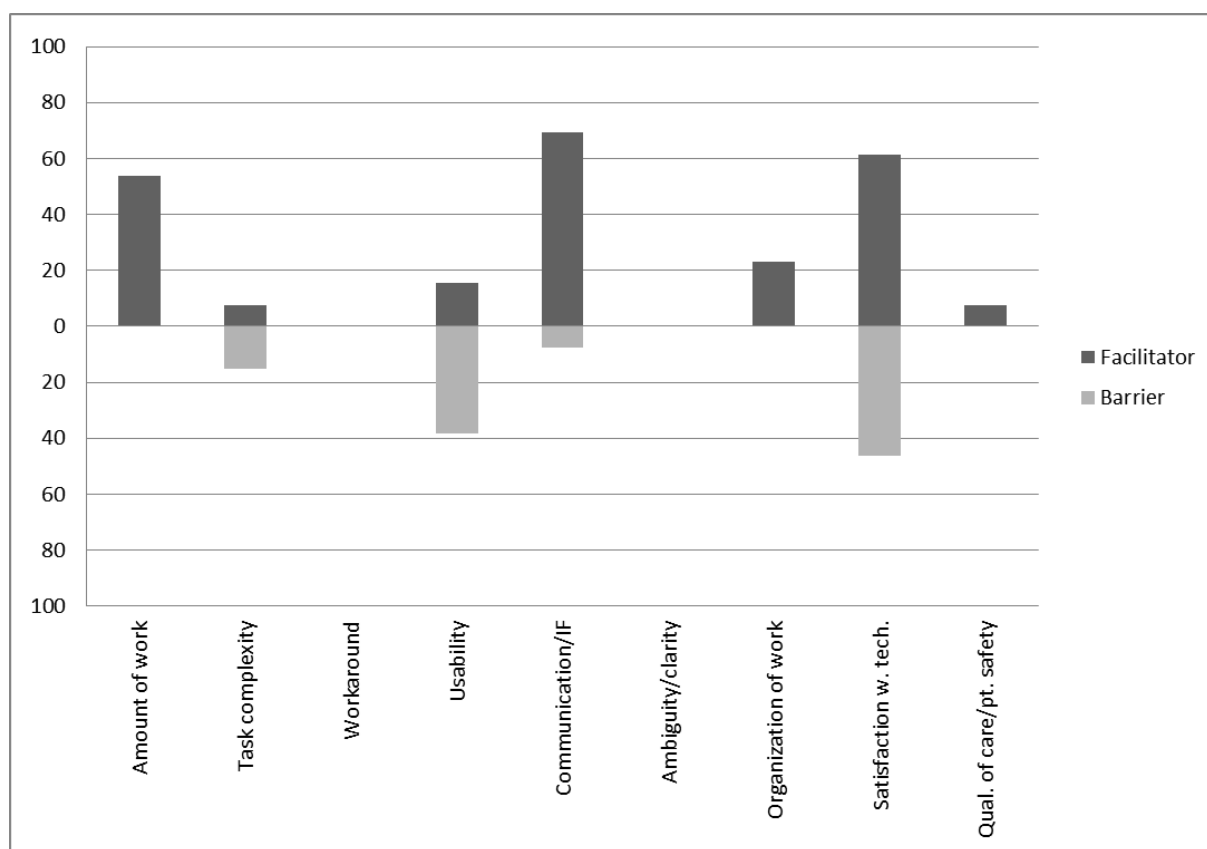
[The typical complaints we get are] I just filled this out, why do I have to do it at each visit? ... For some patients, they may have just done it. They may have had their HIV doctor's appointment Monday and Thursday may be seeing the endocrinologist within that same week. Yes, I know, different doctor, different day. I'd say between three and six [a day] just refuse to do it. (Clinic 4 Receptionist)

One receptionist suggested that these refusals may be caused by the check-in process being stressful for some patients. Other patients may feel that the repeated e-form is unnecessary.

A similar barrier arises with the PRO e-form. Patients who are not feeling well or have just been discharged from the hospital often do not want to fill out the e-form. Other patients are fatigued by the length of the e-form: "[Patients] don't want to go through the whole thing. They get tired of answering all those questions by the end, and so I do let them opt out of it. They don't have to participate" (Clinic 4 Social worker).

4.2.2.3. Facilitators and barriers to the use of e-forms identified by clinic patients. We analyzed patient interview data to identify facilitators and barriers to workflow for the three e-forms. Two interview transcripts were for patient users of the migraine e-form at Clinic 1 and six transcripts were for users of the S&S e-form at Clinic 4. Five of the patients from Clinic 4 had also used the PRO; again, their data related to the PRO are treated as separate interviews. The remaining patient had declined to participate in the PRO study. Thus, Figure 19 below shows the percentage of the 13 patient interviews in which facilitators and barriers related to each dimension were identified.

Figure 19. Facilitators and barriers to the use of e-forms identified in patient interviews (N=13)



Facilitators identified by patients most frequently related to communication, satisfaction with the health IT application, amount of work, and organization of work. Barriers were most often related to satisfaction with the technology and usability. Table 24 shows the number of interviews in which facilitators and barriers for each dimension were mentioned. Overall, patients identified facilitators in more dimensions (an average of 2.4 per interview) than barriers (1.1 per interview).

Table 24. Facilitators and barriers to the use of e-forms identified in patient interviews (N=13)

Dimension	Facilitator	Barrier
Amount of work	7	0
Task complexity/simplicity	1	2
Inappropriate use	NA	0
Workaround	0	NA
Usability	2	5
Communication/information flow	9	1
Ambiguity/clarity	0	0
Organization of work	3	0
Satisfaction with technology	8	6
Quality of care/patient safety	1	0
Mean dimensions per interviewee (SD)	2.4 (1.27)	1.1 (0.82)

4.2.2.3.1. Communication and information flow. Several Clinic 4 patients appreciated the S&S e-form because it makes sharing information about their health easier. The PCP “can pretty much see how I’m feeling. If I don’t feel like talking, they already know what’s going on” (Clinic 4 Patient). This e-form also helped several patients remember all the health issues that they needed to discuss with the provider.

A lot of times when you come in the doctor’s office, you forget everything that you planned to talk to the doctor about. I think it gives you a chance to remember. ... Then it gives you a helping hand. When you get in [the exam room], they’ll say I see you checked this. And you’re like, oh, yeah, I forgot about that. (Clinic 4 Patient)

Several patients said that it was easier for them to be honest when completing e-forms on the computer, rather than having to share the same information in face-to-face interactions with their PCP.

INTERVIEWER: Is it easier than talking to a nurse about it?

PATIENT: To me it is, yeah.

INTERVIEWER: Why is it easier?

PATIENT: I can just express myself more on that computer. [They] ask so many questions about what’s going on with me [in this clinic].

INTERVIEWER: Because some of the topics are kind of private?

PATIENT: Yeah. (Clinic 4 Patient)

4.2.2.3.2. Amount of work. Several patients reported that e-forms are easier to complete than paper forms, because they prefer not to fill out forms by hand or to have to read the small print on a paper form.

INTERVIEWER: Why is it easier than filling out paper forms?

PATIENT: Because I’m a slow writer, for one, and I just think it’s easier just to be able to touch the screen, read, touch the screen. I like that. (Clinic 4 Patient)

Patients also stated that completing the e-forms saves time when they finally see the provider in the exam room because it would take longer to share the same information verbally than it does to complete the form in advance.

4.2.2.3.3. *Organization of work.* Several patients said that completing the S&S e-form before the visit allows the provider to focus on the most important health issues in the exam room.

[The S&S e-form] asks you all of the basic questions [about] the problems that we have with this illness, whether or not you're being nauseous, whether or not you're having diarrhea. ... So when you see the doctor, you've gotten it out of the way. The doctor knows they ... don't have to deal with that, because ... you've checked, no, you don't have that problem so they can move on to the most important things that [are] going on with you. (Clinic 4 Patient)

One patient said that completing the migraine e-form in the waiting room gave her additional time to consider the answer to each question, without the pressure of being in the exam room with the provider.

I like being able to sit and ... think about it. Sometimes when the doctor comes in, he's asking you all these questions, it takes me a minute to think about it. Well, how many headaches have I had this month? So I like being able to do it on my own ahead of time and think about it and fill in the answers. (Clinic 1 Patient)

4.2.2.3.4. *Usability.* Several patients reported usability issues. In Clinic 4, patients reported that the terminals for completing the S&S in the waiting room are often down, which can force patients to wait as long as 15 minutes before completing the e-form. A Clinic 1 patient complained about the e-form freezing up: "I got halfway through [the e-form] and then they had to shut down the whole computer and restart it. And I had to start over" (Clinic 1 Patient).

Other usability issues included worrying about whether the touch screens had been recently disinfected. Also, one patient disliked the fact that the e-form questions were multiple choice and did not allow him to provide more details about his response to some questions.

4.2.2.3.5. *Perceived outcomes.* Several patients expressed satisfaction with the technology, in particular the touch screens used at Clinic 4. Patients liked these screens because they are easy to use and "pretty cool" (Clinic 4 Patient). All of the patients interviewed preferred the e-forms to paper forms.

However, several issues affected patient satisfaction with the Clinic 4 e-forms. Over half of patients stated that the PRO is too long. One patient also did not like having to fill out the PRO repeatedly, when his status had not changed. Another patient was concerned about the lack of privacy when completing the S&S e-form in the waiting room.

4.2.2.4. Comparison of facilitators and barriers to use of e-forms identified by clinicians, staff, and patients. Many of the facilitators related to e-forms are similar for clinicians, staff and patients. For example, all three types of interviewees described the e-forms as facilitating the receipt of true information from patients, especially information on sensitive topics. Clinicians, staff, and patients mentioned that the amount of information gathered in the e-forms allows the providers to focus on the most important issues when they see the patient in the exam room. All three described the e-forms as saving time for clinic staff and for patients, compared with paper forms.

Some barriers were also common across all three groups, such as issues with the systems requiring frequent rebooting. Several patients expressed their frustration with having to complete the e-forms repeatedly, and clinicians and staff agreed that this is a barrier. For clinicians and staff, a related barrier is the need to take the time to convince patients that the e-forms are beneficial to their care.

Other barriers were unique to specific groups. As users of e-form data, clinicians identified barriers related to transferring data into the EHR and accessing e-form data after the patient visit. Clinic 4 providers also identified barriers related to the quality of data when patients are “just clicking through” the e-forms at random. Unlike the other groups at Clinic 4, clinicians found the length of time required to complete the PRO to be a barrier as it slowed the flow of patients through the clinic. Two factors contribute to the impact of the PRO on clinician’s workflow: the relatively long time required to complete it and the fact that it is completed in the exam room—while the provider is waiting to begin the exam—instead of in the waiting room. Patients reported that the PRO was too long, but did not mention it as slowing down their office visit.

Reception staff in Clinic 4 identified the need to help patients complete the S&S in the waiting room as a barrier. The clinic is often very busy, so it is difficult for staff to leave the reception desk long enough to help a patient with literacy, usability, or language issues in completing the e-form. The clinic has responded to this barrier by having volunteer “clinic hosts” available in the waiting room as often as possible. These clinic hosts are often patients who have been with the clinic for many years, or family members of clinic patients. They provide a welcoming atmosphere by greeting patients and helping patients who need assistance in completing the S&S.

In conclusion, e-forms often reduce tasks for staff, because prior to the implementation of the e-form, staff typically were responsible for collecting the same information either using paper forms or verbally, and documenting the information in the EHR. The e-forms also produce some standardization of the tasks performed by providers. E-forms ensure that specific questions are answered by the patient during the office visit. Also, the information derived from the e-forms is presented in a standard manner, which allows the provider to focus on the issues that concern the patient most. Although e-forms may reduce the information that patients can relay by limiting their responses to the options of a multiple-choice question, only one patient mentioned this concern and he nevertheless reported a high satisfaction with e-forms.

4.2.3 Research Question 3: Use of Patient-Provided Information for Workflow Redesign Related to e-forms

Clinic 4 has used e-form data to redesign clinic workflows. Clinicians review the data from the PRO e-form, for quality improvement. For example, the clinic used PRO e-form data to identify the high rates of depression among patients and began providing more counseling services.

[B]y doing PROs regularly across our patients, we have a much better handle on the degree of mental illness that’s in our population. That’s led to the expansion of psychology services. That’s led to additional FTEs being hired, being given offices in these buildings to teach patients, to treat patients. ... [W]hen we have a quality scorecard to fill out, and they ask have you asked about depression, we not only ask everybody about depression in a given year, but we have a much better idea of what’s the distribution of these issues and what programs we need to expand or contract. And that’s incredibly valuable information just for the clinic staffing. (Clinic 4 Physician)

The clinic also developed protocols to provide care based on patient responses to PRO questions on suicidal thoughts and domestic violence. The CNICS system processes the responses related to suicidal ideation, and alerts mental health providers if a patient’s score is above a cut-

off point. A licensed counselor in the clinic receives the alert and immediately talks with the patient. If patient self-harm is considered likely, clinic staff will call an ambulance and have the patient transported to the hospital. This protocol has been so useful that the clinic is considering adding it to clinic workflow for all patients at every visit.

There is discussion about moving some things from the PRO into standard of care, so everybody fills it out, so, for instance, the [medication] adherence and the suicidality assessment, moving some of those things over. (Clinic 4 Physician Leader)

The domestic violence protocol is completed by a social worker, who meets with patients during their first visit to the clinic. During the visit, the social worker asks the patient to complete a lengthened version of the PRO e-form that includes questions about domestic violence. If the patient scores above a certain threshold, the social worker will ask additional questions to assess the patient's safety. If the patient wishes to call the police, the social worker will make the call and help the patient report the abuse. The social worker will also present options, but if the patient does not wish to leave the abusive situation, nothing more is done.

Several additional protocols for patient care have been developed as part of research studies that use PRO data. One such study assesses hazardous alcohol use among HIV patients and provides an alcohol treatment intervention, while another aims to improve the care of depressed patients.

[If a patient] scores five on an audit [of data on alcohol use], a beeper goes off, and a research assistant walks in and says you just scored kind of high. We have a program for intervention. Do you want to do it? That's called the ARCH [Alcohol Research Consortium in HIV] study. And then we have another study that's for depression. If they are [depressed], then rather than having the clinician sort of pick out of the air what medicines go with this, there [are] algorithmic approaches we're showing work pretty damn well. (Clinic 4 Physician)

In the past, some research protocols have become part of standard care in the clinic, but clinic leadership is worried about the effect too many protocols could have on workflow.

We just finished a study called the SLAM DUNC where they basically took people who had a high depression score, and then they randomized them to standard of care or more intensive management [including algorithms for selecting medications]. So we'll see what the results of that are. If it shows that the more intense, I have to believe that the more intense management probably helps, then maybe we should. But, you know, you have to be a little bit careful about the number of protocols you create that you may overwhelm the system with people and protocols (Clinic 4 Physician Leader)

4.3 Uploading Data Through a Patient Portal

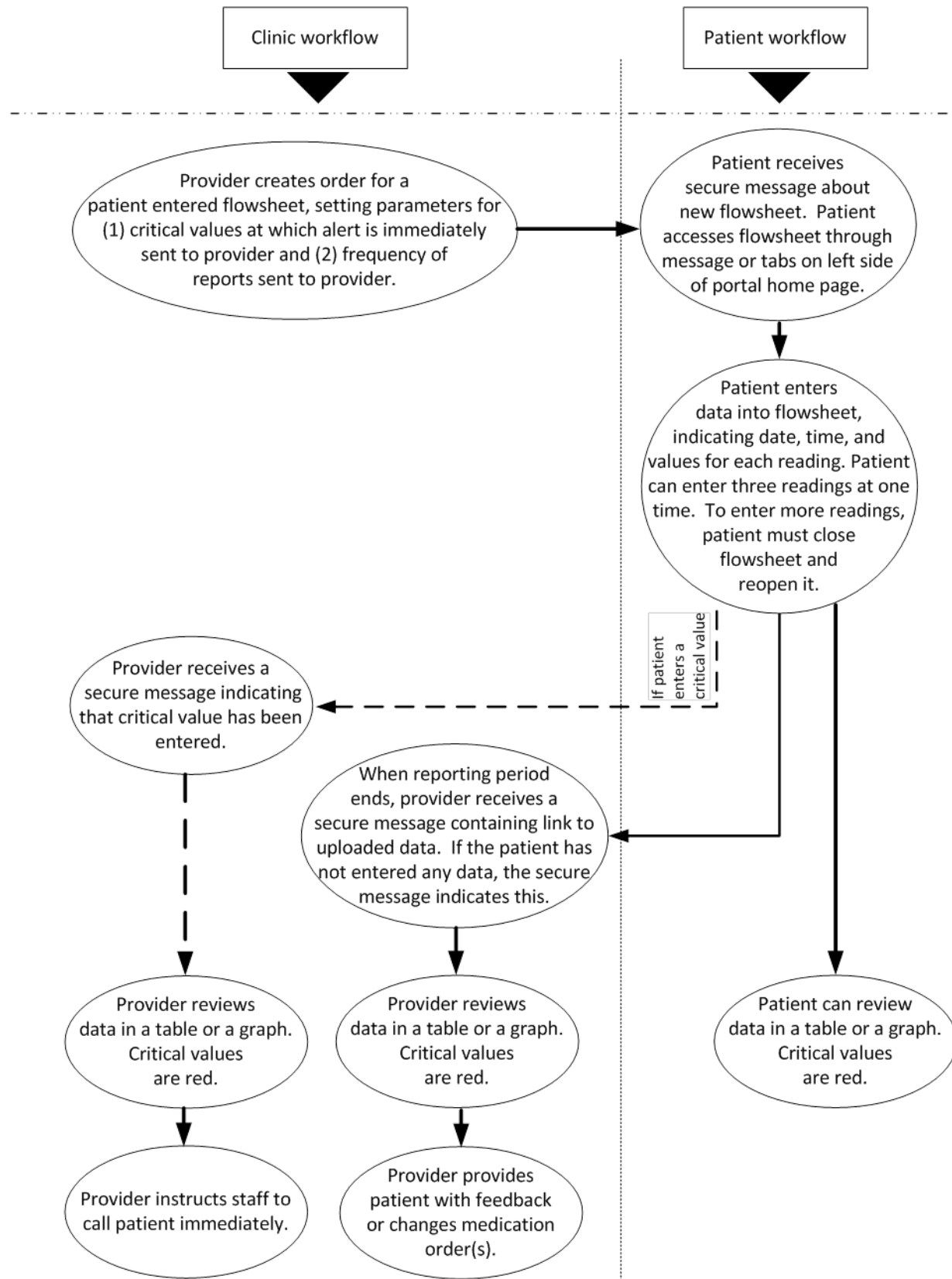
4.3.1 Description of the Health IT Application and Workflow

Two of the study sites, Clinics 3 and 5, have a health IT application that allows patients to upload clinical information through a patient portal. Both clinics use the same application that allows patients to enter measurements of blood pressure or blood glucose into a “flowsheet” after taking readings at home (see Figure 20). The provider must enter an order to give patients access

to the flowsheet, selecting critical values (e.g., systolic blood pressure of 200 or higher) that require immediate contact by the clinic. The provider also selects how often reports should be received by the provider with the data entered by the patient. The default reporting period is 30 days.

Once the order is entered, the patient receives a secure message and can open the flowsheet by clicking a link in the message or a link on the patient portal. The patient then can enter data into boxes in the flowsheet section of the patient portal: date of reading, time of reading, and reading value(s). The patient can enter data for up to three readings. To enter more readings s/he must close and reopen the flowsheet. The patient can review the data, including data entered on prior days, in table form or in a graph. If the patient enters a reading above a high critical value or below a low critical value, the value appears in red on the table or graph, and the ordering provider receives an immediate message in an in-basket folder labeled "Pt Entered Flowsheet." The provider then asks a nurse to call the patient as soon as possible. After the specified reporting period is over, the ordering provider receives a secure message in the flowsheet folder and can review the patient-entered data in table form or a graph. As long as the order is active, the provider will receive secure messages for each reporting period, even if the patient has not entered any data. After reviewing the patient-entered data, the provider contacts the patient with feedback, makes needed changes to medication orders, or requests that the patient schedule an appointment.

Figure 20. Use of a patient portal to upload patient readings of blood pressure and blood glucose



4.3.1.1. Clinic 3. In Clinic 3 only one provider has used this health IT application, ordering flowsheets for approximately 10 of his patients. Four of these patients entered data for a brief period, but none are currently using the application. This provider reported that the patients did not like using it, complaining in particular about the limitation of being able to enter only three values at one time. We spoke to this provider about his experience with the application but were unable to interview any patients who had used it.

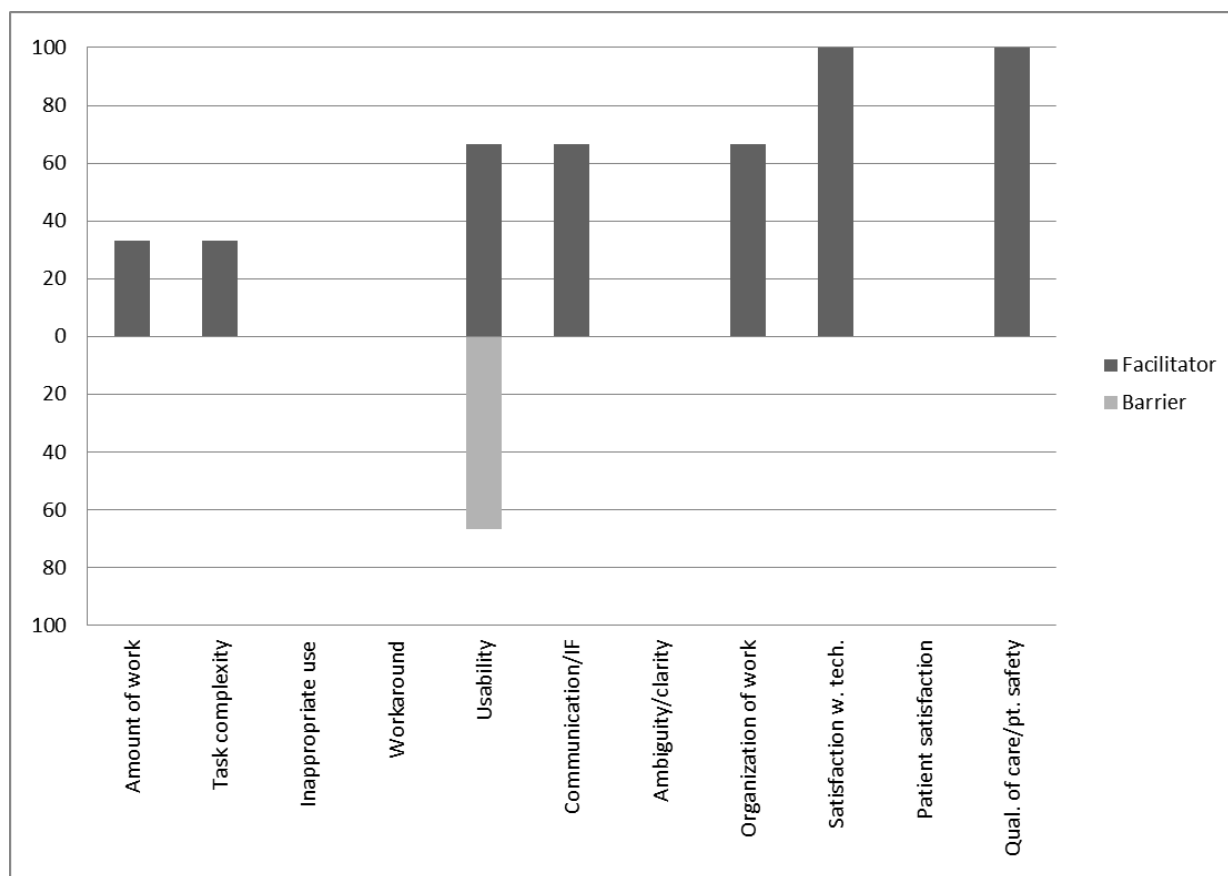
4.3.1.2. Clinic 5. In Clinic 5 two providers had asked their patients to use this health IT application to enter data on blood sugar or blood pressure levels. We interviewed both providers about their experience with this application and also interviewed three patients who were using or had used it.

4.3.1.3. Analyses of uploading clinical data into a patient portal. Our analysis for research question 1 includes the provider from Clinic 3 and both providers from Clinic 5. However, because of the limited data for Clinic 3, we will not answer research question 2 for this health IT application. None of the data applies to research question 3, so this question will not be addressed for this application either.

4.3.2 Research Question 1: Facilitators and Barriers To Uploading Data Into Patient Portal

4.3.2.1. Facilitators and barriers to uploading data into patient portal identified by clinicians. Three providers offered insights about facilitators and barriers to workflow related to patients uploading data into a patient portal. Nurses were not aware of the health IT application, and provided no data. Results in Figure 21 show that providers frequently identified facilitators related to communication, the organization of work, satisfaction with the health IT application, patient safety and quality of care, and usability. Providers mentioned only barriers related to usability.

Figure 21. Facilitators and barriers to uploading data into a patient portal identified in clinician interviews (N=3)



As can be seen in Table 25, providers identified far more facilitators to the use of this health IT application (an average of 4.7 per interview) than barriers (0.7 per interview).

Table 25. Facilitators and barriers to uploading data into a patient portal identified by clinicians (N=3)

Dimension	Facilitator	Barrier
Amount of work	1	0
Task complexity/simplicity	1	0
Inappropriate use	NA	0
Workaround	0	0
Usability	2	2
Communication/information flow	2	0
Ambiguity/clarity	0	0
Organization of work	2	0
Satisfaction with technology	3	0
Patient satisfaction	0	0
Quality of care/patient safety	3	0
Mean dimensions per interview (SD)	4.7 (0.47)	0.7 (0.47)

Communication facilitators included the fact that patients who use the flowsheet give providers useful information about their health.

Most of the patients that are uploading their information, they're already well aware of what their blood pressure readings are. They usually have their own paper copy too. But ... it can be helpful for both of us because [at the clinic] we can get that information. (Clinic 5 Physician)

One provider particularly likes the structure of the information arriving through the flowsheet and the ability to display it in an organized way.

If they just send [the readings in a secure message], it's very hard to go back and see it and get a flowsheet and see what's happening. So if they'll put it in a flowsheet, then it's certainly nicer data, much easier to see it. (Clinic 5 Physician)

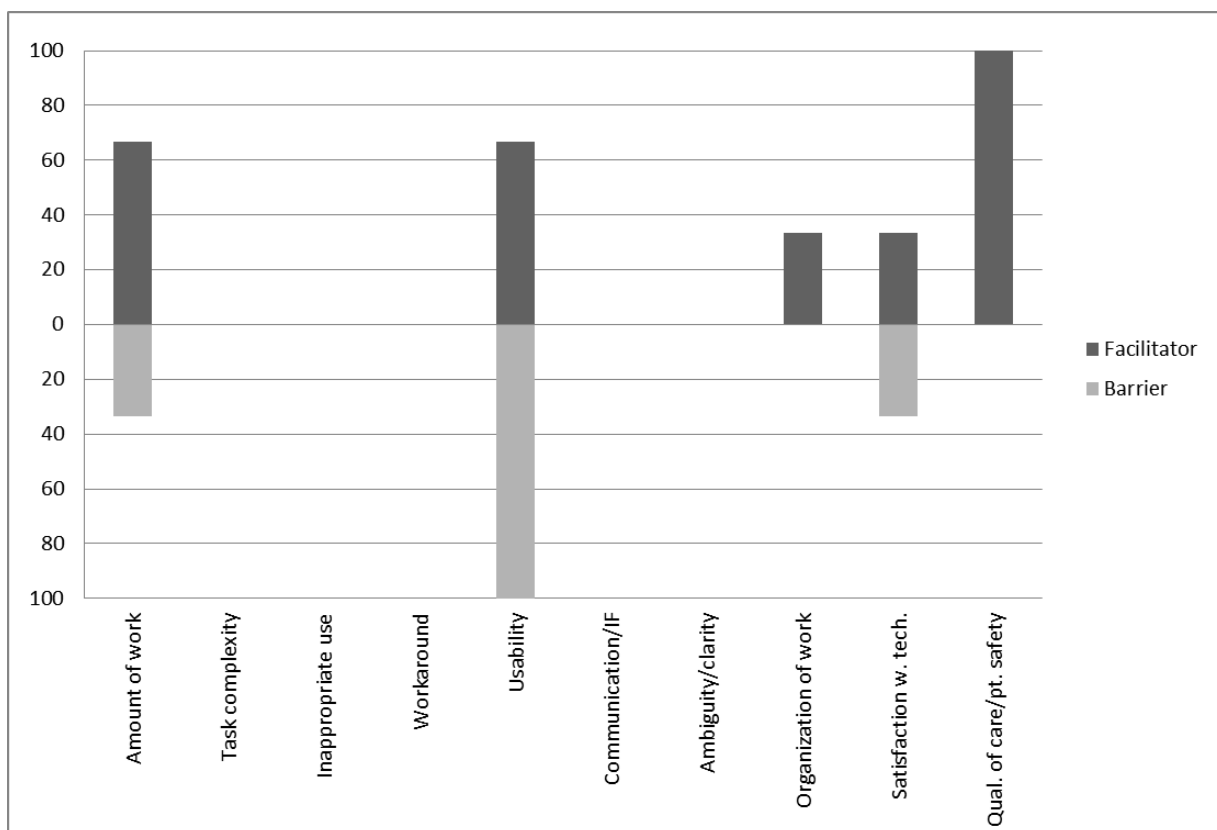
Other facilitators were related to the organization of work. Compared with having patients report the same information in a phone call to the nurse, providers preferred the flowsheet because patients enter the data, rather than “highly paid and busy clinic staff” (Clinic 1 Physician). Providers stated that when patients frequently report information through the flowsheet, it allows the providers to postpone bringing some of those patients in for appointments. They can adjust patients' medication and communicate the change to patients using secure messaging, providing care without a clinic visit or phone call.

All three providers also reported facilitators related to the quality of care and patient safety. For example, use of the flow sheet helps patients to manage chronic conditions: “I think that a diabetic [patient] who used the flow sheet identified what it was that was making his sugars high through that tool. I think that helped him to manage his condition” (Clinic 3 Physician). Providers also mentioned that the health IT application helps patients to identify readings that are outside of their normal range and to track the effects of their medications.

Usability facilitators included the fact that the information is sent directly to the provider and is easy to find again at a later time. A usability barrier is that the graphing function displays the earliest readings on the right side and the most recent readings on the left. Time series data are usually presented with the earliest data on the left, so this presentation was confusing for providers.

4.3.2.2. Facilitators and barriers to uploading data into patient portal identified by clinic patients. Three patients of Clinic 5 who use a patient portal to upload information were interviewed about this health IT application. As the results in Figure 22 show, these three patients identified facilitators related to quality of care and patient safety, the amount of work, usability, the organization of work, and satisfaction with the health IT application. Barriers were primarily related to usability, as well as the amount of work and satisfaction with technology.

Figure 22. Facilitators and barriers to uploading data into a patient portal identified in patient interviews (N=3)



Results in Table 26 show that patients identified more facilitators (an average of 2.7 per interview) than barriers (1.7 per interview).

Table 26. Facilitators and barriers to uploading data into a patient portal identified in patient interviews (N=3)

Dimension	Facilitator	Barrier
Amount of work	2	1
Task complexity/simplicity	0	0
Inappropriate use	0	0
Workaround	0	0
Usability	2	3
Communication/information flow	0	0
Ambiguity/clarity	0	0
Organization of work	1	0
Satisfaction with technology	2	1
Quality of care/patient safety	1	0
Mean dimensions per interview (SD)	2.7 (2.05)	1.7 (0.94)

Two patients mentioned facilitators related to the amount and organization of work, specifically the amount of time required to share information with the clinic.

It's probably less time of mine and the clinic's [than sharing the information by phone], because making a phone call, you'd have to find the right person. ... [It] would have to be to one of the nurses for my doctor. I'd be on hold for a while, and then we'd both be spending [several minutes] to write down numbers and things. [Uploading the information,] it's much faster for [the physician.] He was very diligent about getting back to me every so often. I would get an email about my charting. (Clinic 5 Patient)

Similarly, another patient stated that he preferred to upload information on his blood pressure readings instead of playing phone tag with clinic staff to share the information by phone.

One facilitator related to the quality of care and patient safety was that the patient found he thought more about his blood sugar readings because he entered them into a patient portal: "It forces me to look at the numbers as I type them in. ... When I do my blood sugar reading, I see it on my meter, but then manually having to enter it also kind of reinforces that" (Clinic 5 Patient).

We identified both facilitators and barriers related to usability. Two patients found the software to be very intuitive and had no trouble learning how to enter readings. However, one patient was not satisfied with the amount of time required to enter the information. She found it "irritating" and time-consuming, compared with her own system of entering data into an Excel spreadsheet. Another barrier was related to finding and opening the application in the patient portal. Two patients found this difficult; both wrote down detailed notes to remind themselves how to do it. Other usability barriers included the fact that the health IT application could not be used on the mobile version of the clinic's patient portal. One patient would have liked to record changes in her medications so that she could see on the graph how the changes affected her blood pressure readings. Another patient said that the graphing function did not work correctly for readings that were entered in the early morning, because the readings were graphed for the wrong day.

4.3.2.3. Comparison of facilitators and barriers for clinicians and patients. Both providers and patients agree that uploading data into a patient portal is less work for patients and clinic staff, and improves workflow relative to having patients call the clinic to relay the same information. Both also agreed that this health IT application can improve patient engagement and thereby have beneficial effects on the quality of care.

Usability barriers to uploading data were primarily on the side of patients. Specifically, data entry is onerous for patients, while the receipt of data by providers is not. Because of the work involved for patients, patient satisfaction with uploading information was fairly low, compared with clinician satisfaction. One patient reported being very satisfied, another reported being slightly satisfied, and the third was dissatisfied. The third patient had stopped using the application because of her “irritation” with usability issues. In contrast, all three providers reported being highly satisfied with the application.

5. Discussion

This study examined three research questions:

1. How does the use of health information technology (IT) to capture and use patient-reported information support or hinder the workflow from the viewpoints of clinicians, office staff, and patients?
2. How does the sociotechnical context influence workflow related to the capture and use of patient-reported information?
3. How do clinics redesign their workflows to incorporate the capture and use of patient-reported information?

In this section we discuss the results with regard to the three research questions across the different health IT applications. There are five clinics that use secure messaging, two clinics that use e-forms, and two clinics that allow patients to use a patient portal to upload information. For the latter two health IT applications, available data are limited.

5.1 Research question 1: How Does the Use of Health IT To Capture and Use Patient-Reported Information Support or Hinder the Workflow From the Viewpoints of Clinicians, Office Staff, and Patients?

The results of our analysis show that the health IT applications used by patients to report information to the clinic electronically have a different impact on the workflow for clinicians, staff, and patients (see tables 27–29).

Table 27. Summary table of facilitators and barriers identified in clinician interviews, by health IT application

Dimension	Secure messaging (N=38)		E-forms (N=27)		Patient portal to upload (N=3)	
	Facilitator	Barrier	Facilitator	Barrier	Facilitator	Barrier
Amount of work	46%	49%	44%	11%	33%	0%
Task complexity/simplicity	8%	22%	4%	7%	33%	0%
Inappropriate use	NA	62%	NA	7%	NA	0%
Workaround	8%	NA	7%	NA	0%	NA
Usability	24%	51%	11%	33%	67%	67%
Communication/information flow	76%	84%	44%	26%	67%	0%
Ambiguity/clarity	8%	43%	7%	0%	0%	0%
Organization of work	62%	46%	41%	41%	67%	0%
Satisfaction with technology	43%	19%	15%	19%	100%	0%
Patient satisfaction	51%	19%	15%	30%	0%	0%
Quality of care/patient safety	51%	24%	30%	0%	100%	0%
Mean dimensions per interview (SD)	3.7 (2.06)	4.1 (2.04)	2.9 (1.74)	2.3 (1.38)	4.7 (0.47)	0.7 (0.47)

Results in Table 27 show that more clinicians in the six clinics used secure messaging (N=38 clinicians) than used e-forms (N=27 interviews with 15 clinicians) or allowed patients to upload information into a patient portal (N=3 clinicians). Second, results show that clinicians mention more barriers on average (4.1 per interview) than facilitators (3.7) to the secure messaging

workflow, but slightly more facilitators (2.9) than barriers (2.3) to the e-form workflow, and many more facilitators (4.7) than barriers (0.7) to the workflow of patients using a patient portal to upload clinical information. The barrier to secure messaging that was most often mentioned is its negative impact on the communication and information flow (84 percent of interviews). The largest barrier to e-forms is the impact that their use can have on the organization of work (41 percent), and the largest barrier to patients' use of a patient portal to upload information is poor usability of this health IT application (67 percent). Note that poor usability is mentioned as a barrier for all three health IT applications. The largest facilitator to secure messaging and e-forms is communication and information flow (76 percent and 44 percent respectively). The largest facilitator to uploading information is satisfaction with the health IT application (100 percent) on the part of clinicians. Note that communication and information flow is often mentioned as a facilitator for all three applications.

In summary, the three health IT applications have a different impact on clinician workflow. The workflow barriers to the three applications are different, although usability issues are mentioned for all three applications. The largest common facilitator to the three health IT applications is communication and information flow.

Table 28 summarizes the results of the comparison of facilitators and barriers to the three health IT applications for staff interviews.

Table 28. Summary table facilitators and barriers for three health IT applications, staff interviews

Dimension	Secure messaging (n=12)		E-forms (N=7)		Patient portal to upload (N=0)	
	Facilitator	Barrier	Facilitator	Barrier	Facilitator	Barrier
Amount of work	50%	42%	71%	14%	NA	NA
Task complexity/simplicity	17%	17%	0%	0%	NA	NA
Inappropriate use	NA	17%	NA	14%	NA	NA
Workaround	8%	NA	0%	NA	NA	NA
Usability	33%	33%	14%	6	NA	NA
Communication/information flow	58%	42%	56%	14%	NA	NA
Ambiguity/clarity	25%	42%	0%	0%	NA	NA
Organization of work	58%	33%	71%	29%	NA	NA
Satisfaction with technology	42%	25%	29%	14%	NA	NA
Patient satisfaction	17%	8%	29%	56%	NA	NA
Quality of care/patient safety	33%	0%	29%	0%	NA	NA
Mean dimensions per interview (SD)	3.3 (2.21)	2.4 (2.07)	3.4 (1.68)	2.1 (1.81)	NA	NA

Results in Table 28 show that staff are not involved in the use of a patient portal to upload information. Second, slightly more staff are involved in the secure messaging workflow (N=12 interviewees) at the three research sites than in the e-forms workflow (N=7 interviewees). Results show further that, overall, staff more frequently mention facilitators (3.3 per interview, on average) than barriers (2.4) to secure messaging, and also more facilitators (3.4 per interview) than barriers (2.1) to e-forms. According to staff, the largest barriers to secure messaging are the amount of work, the communication and information flow, and ambiguity (42 percent for each dimension), while the largest barriers to e-forms are patient satisfaction and usability (56 percent for each). The largest facilitators to secure messaging are communication and information flow and organization of work (58 percent for each), and the amount of work (50 percent). The largest facilitators to e-forms are the amount of work and the organization of work (71 percent for each), and communication and information flow (56 percent).

In summary, according to staff the most important facilitators for the two health IT applications (secure messaging and e-forms) are similar (amount of work, communication and information flow, and organization of work), but the barriers are different.

Table 29 summarizes the results of the comparison of facilitators and barriers to the three health IT applications for patients.

Table 29. Summary table facilitators and barriers for three health IT applications, patient interviews

Dimension	Secure messaging (N=27)		E-forms (N=13)		Patient portal to upload (N=3)	
	Facilitator	Barrier	Facilitator	Barrier	Facilitator	Barrier
Amount of work	30%	11%	54%	0%	67%	33%
Task complexity/simplicity	37%	4%	8%	15%	0%	0%
Inappropriate use	NA	0%	NA	0%	NA	0%
Workaround	4%	NA	0%	NA	0%	NA
Usability	41%	26%	15%	38%	67%	100%
Communication/information flow	52%	0%	69%	8%	0%	0%
Ambiguity/clarity	15%	4%	0%	0%	0%	0%
Organization of work	81%	7%	23%	0%	33%	0%
Satisfaction with technology	52%	4%	62%	46%	33%	33%
Quality of care/patient safety	11%	0%	8%	0%	100%	0%
Mean dimensions per interviewee (SD)	3.2 (1.50)	0.6 (0.78)	2.4 (1.27)	1.1 (0.82)	2.7 (2.05)	1.7 (0.94)

Results in Table 29 show that patients in our study more often use secure messaging (N=27 patients) than e-forms (N=13 interviews with seven patients) or a patient portal to upload information (N=3 patients). Overall, patients more frequently mention facilitators than barriers to all three applications. The difference between the average number of facilitators mentioned and the average number of barriers is larger for secure messaging (3.2 versus 0.6), relative to e-forms (2.4 versus 1.1) and uploading information into a patient portal (2.7 versus 1.7). The most frequently mentioned facilitator for secure messaging is the organization of work (81 percent); for e-forms it is the communication and information flow (69 percent); and for using a patient portal to upload information it is the amount of work and usability (67 percent for each). The largest barrier to secure messaging (26 percent) and uploading data (100 percent) is poor usability, which is also mentioned frequently for e-forms (38 percent). The largest barrier to e-forms is satisfaction with the health IT application (46 percent). Note that patients identify the amount and organization of work as a facilitator for all three health IT applications, and that patients frequently describe their satisfaction with secure messaging and e-forms.

In summary, the facilitators identified by patients differ for the three health IT applications, but the barriers are similar. Poor usability is a barrier frequently mentioned for all three applications, while patient satisfaction is mentioned for e-forms and uploading data into a patient portal. In some cases, poor usability or dissatisfaction has caused patients to stop using a health IT application.

If we compare the results for clinicians, staff, and patients, we can draw the following conclusions with regard to how the use of health IT to capture and use patient-reported information supports or hinders the workflow. Of the three applications, secure messaging has the largest negative impact on workflow of clinicians. On average, clinicians mention more barriers to this application than to either e-forms or uploading information. They also identified more barriers than facilitators to the use of secure messaging. E-forms and uploading information have

a more positive impact on the workflow of clinicians, and clinicians report more facilitators than barriers to the use of these two health IT applications. We found a moderately positive impact of secure messaging and e-forms on workflow of staff. Staff report more facilitators to these health IT applications than barriers, and a high percentage of staff report facilitators related to the amount of work, organization of work, and communication. Overall, patients are satisfied with the three applications, and the applications have a generally positive impact on their workflow. An exception is poor usability. Patients report usability issues for all three applications, especially for using a patient portal to upload information. Several patients have stopped using their patient portal to upload information, and providers report that only motivated patients use this health IT application.

5.2 Research question 2: How Does the Sociotechnical Context Influence the Workflow Related to the Capture and Use of Patient-Reported Information?

In this section we describe how the sociotechnical context influences the workflow related to patient-reported information. The sociotechnical contexts consist of five elements: the environment, the organization, the tools and technology, the person, and the tasks (see Figure 1, the SEIPS model).

Several factors in the sociotechnical context influence workflow related to patient-reported information. Five of the six clinics in our study use secure messaging, and by comparing the clinics, we can draw some conclusions about the influence of the sociotechnical context. For the other two health IT applications, we do not have enough data to assess the impact of the sociotechnical context.

Results of our analyses show more similarities than differences in the workflows in the facilitators and barriers to secure messaging across clinics. This finding suggests that, overall, the facilitators and barriers are the result of the health IT application regardless of the sociotechnical context. Four of five clinics use very similar patient portals, from the same vendor, through which patients can send secure messages, and the facilitators and barriers to secure messaging may also reflect the specifics of this portal system. However, it is difficult to draw conclusions on this point, because the only clinic that uses a different health IT vendor also has other characteristics that are different: it is a solo physician practice with a different workflow than the other four larger clinics. Nevertheless we identified some differences between clinics that were related to technological organizational and personal aspects of the sociotechnical context.

For clinics the length of time since health IT implementation has an important impact on workflow. The literature shows that patient uptake of patient portals is slow;^{12,13} it takes time for patients to sign up for a clinic's patient portal and even more time before patients actively start using health IT applications in the portal, for example sending secure messages to the clinic. Clinics that only recently implemented a patient portal have fewer patients signed up or actively using the applications, and therefore a lower volume of secure messages. Table 19 shows the volume of secure messages in the clinics that participated in this study. The clinics that have a longer history receive substantially more messages than clinics that only recently have implemented this health IT application. Obviously clinicians who only receive one secure message a week will experience less impact on their workflow than clinicians with a large volume of messages.

Another factor that has an impact on the workflow related to these health IT applications are the other tools and technology that are in use in a clinic. In all of the clinics studied, secure messaging is part of their patient portals, and consequently integrated into the electronic health record (EHR). The availability and compatibility of other health IT applications and tools thus has an impact on the secure messaging workflow. For example, if patients can use the e-prescribing application in their patient portal, they do not have to send a secure message to ask for a medication refill. For e-forms the fact that the health IT applications are not able to transfer information directly to the EHR (in Clinic 1 and 4) has a major impact on the e-form workflow. Additional steps need to be taken (copying and pasting, printing and scanning) to transfer the information into the EHR and store it for later retrieval.

A third sociotechnical factor that has an impact on workflow is whether the clinic is part of a larger health care organization. This factor partly overlaps with the first factor that we mentioned. The independent clinics in our sample find it difficult to buy the same EHR that the larger health care organizations (HCOs) use. For example, Epic does not sell their product to small HCOs. Independent clinics have the choice to buy an EHR from a smaller vendor (as Clinic 2 did), or to contract with a larger HCO to use their EHR. For the latter option, clinics would know that (1) their EHR is compatible with the EHR of the larger HCO and (2) that they would be able to access medical records when patients are admitted to the hospital of the larger HCO. However, the clinics are also dependent for health IT support on the larger HCO, and the clinics are often not considered to be the highest priority when they need help or would like to make changes to the EHR.

A fourth sociotechnical factor that has an impact on the workflow related to patient-reported information is the percentage of clinicians and staff who work part-time. Two clinics in our study (Clinics 4 and 6) employ a relatively large number of part-time clinicians (see Table 2). Compared with full-time employees, part-time workers have less time to become familiar with and adapt to the health IT in that specific clinic. In general, part-time employees are less familiar with the health IT and the associated workflows. The scheduling of training in most clinics exacerbates this problem. Clinics often train their employees during lunch break on a specific day during the week. If the part-time employee does not work on that day, s/he would not receive the health IT training. Unfamiliarity with the health IT and lack of training in the use of health IT impact workflow.

A fifth sociotechnical factor that has an impact on the workflow related to patient-reported information is the organizational structure (organization) in the clinic. Clinic 2 has only one clinician who works with an MA and other nonclinical staff. This obviously affects workflow in the clinic. Only the provider can make clinical decisions, and so he triages secure messages. Secure messages add to the provider's workload, although he is able to distribute some of the workload to the MA, the clinic manager, the receptionist, and the billing specialist. The other five clinics have implemented a patient-centered medical home (PCMH) model of care; doing that has an important impact on clinical workflow, but it takes time and effort before clinics become efficient at adhering to this model.⁶⁵⁻⁶⁷ Integrating patient-reported information in the PCMH also takes time, and therefore the history of PCMH implementation also influences the patient-reported workflow. Clinic 1 has a longer history with PCMH than Clinics 5 and 6, and is more efficient in redistributing the tasks (see Figures 2, 5, and 6). In Clinic 1, clinicians and staff are involved in secure messaging, while in Clinics 5 and 6, tasks related to secure messaging are completed by providers and triage nurses.

Patient-provided information also has an impact on the *tasks* that clinicians, staff, and patients perform, and where the tasks are performed (interaction task and environment). Clinicians, staff, and patients all spend more time using computers, which may reduce the amount of face-to-face communication. This may add to clinicians' workload. The tasks of triage nurses may become more difficult, because (1) the nurses lack the auditory cues received in phone and face-to-face conversation, and (2) secure messages may be long, complex, or include a lot of extraneous information. One advantage of secure messaging is that communication can be asynchronous: clinicians and staff are able to perform the tasks associated with a message when it is convenient for them. Patients have that same advantage, sending messages at times convenient for them.

Another sociotechnical factor that has an impact on the workflow related to patient-reported information is individual differences (the person). Within clinics, providers differ substantially in their attitudes toward secure messaging: some providers embrace secure messaging enthusiastically and the opportunities it offers for improvement of patient-provider communication. Other providers would prefer not to use it, especially because the time spent on secure messaging is not reimbursed. The preferences of the provider also affect how the provider and nurse collaborate. Some nurses read secure messages and even if they need provider input, first do research and route the message with a recommendation to the provider. Other nurses forward nearly all messages to the provider, and rarely do research first. These differences and individual preferences have an impact on the clinic workflow. Individual differences also play a role in the use of other health IT application. Clinic 1 implemented the headache e-form because the provider strongly preferred using this application to the paper forms that had previously been used. In Clinic 4, providers vary substantially in how they use the patient-reported outcomes (PRO) e-form data in the examination room. Finally, only a few clinicians chose to use the health IT application that allows patients to upload information into their patient portal. This application is available to 10 other providers who have chosen not to use it.

The last two sociotechnical factors that have an impact on the workflow related to patient-provided information are both related to patient characteristics. One factor that has an impact on secure messaging workflow is language (person). The patient population of Clinic 6 includes many patients who primarily speak Spanish, Hmong, or another language, but the clinic's patient portal is available only in English, limiting the ability of these patients to use it. Several publications have emphasized the importance of making a patient portal available in other languages.⁶⁸⁻⁷⁰ We were not able to find any studies that examined the impact on workflow in the clinic of having a patient portal in multiple languages, but it would obviously create the need for bilingual staff who can address messages.

5.3 Research question 3: How Do Clinics Redesign Their Workflows To Incorporate The Capture and Use of Patient-Reported Information?

Most of the clinics studied did not redesign their workflow to optimize the use of patient-reported information. Some clinic leaders do not realize that they can use the information in the EHR to redesign their workflows, and others run reports on a regular basis but are not focused on workflows related to patient-reported information. As is described in more detail in Section 4.1.4 and 4.2.3, however, there were two exceptions in which clinics in this study used patient-provided information to redesign workflows.

In Clinic 1, the relatively large volume of secure messages was having an impact on workload of the providers. This fact led two providers to collect data on the volume of secure messages per provider and the time required to address specific types of messages. The clinic used this data to redistribute the workload among its PCMH teams, and to compensate providers with high levels of messaging-related work.

Clinic 4 leaders have examined the data from its two e-forms and learned of important issues affecting its patient population, such as high rates of depression. This realization led the clinic to add mental health staff. Also, researchers at the clinic have conducted several studies using PRO data that involved developing protocols to improve patient care. If the protocols are successful, they are sometimes implemented permanently across the clinic. One such protocol involves alerting clinicians if a patient scores higher than a cut-off score on suicidal thinking, in which case steps are taken to prevent the patient from harming him or herself. Other protocols have been developed for domestic violence and depression, and more protocols will be developed in the future. These protocols have an obvious impact on the workflow in the clinic.

5.4 Study Limitations

Our research has several limitations. First, our multiple case study design included six cases, which limits the generalizability of our findings. For secure messaging, we analyzed data collected in five clinics, but data for the other two health IT applications are more limited. Three of the clinics studied had used e-forms in some capacity, but only in two clinics were the e-forms used frequently enough for us to collect a sufficient volume of data to enable analysis. As for allowing patients to upload data into a patient portal, only three providers in the study clinics had used this application, and one had ceased to use it. We were able to interview three patients who had used the health IT application, but one of the patients had also ceased to use it. The small amount of data limits our ability to fully answer the research questions for these health IT applications; however, the small amount also reflects the limited use of these health IT applications in primary care clinics at present. Very little research has been done on the effect of these health IT applications on workflow, so our contribution to the understanding of these applications is nevertheless important.

Although the multiple case study design is a strength of this research, our design did not permit researchers to observe the workflows of patients in using the health IT applications outside of the clinic. Further research focused on patient workflows could be beneficial to gain a more complete understanding of the facilitators and barriers patients face. Another limitation is that we conducted interviews only with patients who had used the applications. Patients who choose not to use these applications are likely to have a very different perspective on the facilitators and barriers to their use.

6. Conclusion

In this study we used a multiple case study design to examine the impact on workflow of three health information technology (IT) applications that allow patients to electronically provide information to their primary care clinic. The study examined three research questions:

- Research question 1: How does the use of health IT to capture and use patient-reported information support or hinder the workflow from the viewpoints of clinicians, clinic staff, and patients?
- Research question 2: How does the sociotechnical context influence workflow related to patient-reported information?
- Research question 3: How do clinics redesign their workflows to incorporate that capture and use of patient-reported information?

Table 30 summarizes the main results of our study.

Table 30. Summary table of results

	Secure messaging	E-forms	Patient portal to upload information
How does the use of health IT to capture and use patient-reported information support or hinder the workflow from the viewpoints of clinicians, clinic staff, and patients?	Secure messaging has both negative and positive effects on workflow of clinicians and staff, who identified both facilitators and barriers to workflow. Patients generally reported that secure messaging has a positive impact on their workflow.	E-forms have a generally positive impact on workflow of clinicians and staff, but patients identified more barriers to workflow related to use of e-forms.	Patients uploading information has a positive impact on the workflow of clinicians, who identified mostly facilitators related to the use of this health IT application. Patients are also positive about this application, but identified several usability issues.
How does the sociotechnical context influence workflow related to the capture and use of patient-reported information?	The sociotechnical context influences workflow related to patient-reported information. The impact on clinicians and staff depends largely on volume and work organization.	We did not have sufficient data to address this question.	We did not have sufficient data to address this question.
How do clinics redesign their workflow to incorporate the capture and use of patient-reported information?	Most clinics do not redesign their workflow to incorporate the use of secure messaging. However, one study site examined the effect of messaging on workflow and made changes to address issues identified.	Most clinics do not redesign their workflow based on information provided in e-forms. One study site, however, reviewed the information provided by patients through e-forms and made several changes to workflow in response.	Very few patients uploaded information through a patient portal. The clinics studied did not redesign their workflow related to the use of this health IT application.

Giving patients the option to share information with their clinicians electronically is a recent addition to health IT. The literature contains only limited evidence indicating that health outcomes are improved by the introduction of patient portals or allowing patients to provide information electronically. However, some evidence indicates that these health IT applications may improve process measures, such as greater adherence, better self-care, improved patient-provider communication, and patient satisfaction. The results of this study support the findings in the literature that patients sharing their information with clinicians electronically can facilitate communication, improve the organization of work, reduce workload, and increase patient satisfaction. However, results also show that some of these same dimensions (e.g., amount of work) can be a barrier. In other words: implementation of these health IT applications—in particular, secure messaging—can have benefits, but they can also hinder workflow and, for example, increase physicians’ workload. In their systematic review on patients’ access to their own medical records, patient self-reported data, secure messaging, online reminders, and the relationship of these health IT applications with health outcomes, Goldzweig et al.¹ concluded that: “Health IT [including secure messaging] is a tool, and if implemented by itself may have modest or even no measurable effect, but health IT can enable the implementation of more comprehensive programs that have meaningful effects on quality of care” (p. 35). In addition, findings from this study show that poor usability of the applications also plays an important role as a significant workflow barrier.

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Appendix A. Preliminary Conference Call Guide

Hello, my name is _____. As you may recall, I am calling from the University of Wisconsin-Madison. Thank you for agreeing to speak with us today.

On the phone is my colleague _____, also from the University of Wisconsin-Madison.

We scheduled up to one hour for this call. Does this time still work with your schedule?

Thank you for the time to discuss this study. We are here to answer any questions or concerns you may have about your practice's participation in the study and our visit to your practice.

Review the following topics:

Goal of the study

The goal of this project understand the influence of things such as patient or provider characteristics; physical environment and layout; technical training and support; functionality and usability of health IT; worker roles; staff workload, stress, and job satisfaction; and communication flows—in capturing and using patient-reported information in ambulatory health IT systems and associated workflows.

Definition and examples of patient-reported information

Patient-reported information can include symptoms (e.g., pain, fatigue), results of self-testing (e.g., blood glucose levels, blood pressure), weight questions and concerns, or over-the-counter medication use. Patients may be able to share with the practice using e-forms (pre-formatted information collection mechanisms), secure messaging (email) between patients and providers, and patient portals (sometimes referred to as [electronic] personal health records or PHRs. Patient portals allow patients to view portions of their medical records [e.g., view laboratory test results] and support other health-related tasks such as making appointments or requesting medication refills). For example, more and more physicians' practices are using secure messaging for communication between patients and their providers.

Site visit schedule, including involvement of clinicians, office staff, and patients

Data will be collected during the site visit to take place from XX/XX to XX/XX. Researchers will be collecting data from clinicians and staff through observations and interviews. Clinicians and staff will also be asked to fill out a short survey. Finally, a few patients in your practice will be asked what they think about providing information using health information technology applications.

Types of questions to be asked of clinicians, office staff, and patients

The clinician and office staff interviews will include discussion about the workflow observed during observations of clinician and office staff, facilitators and barriers to capturing and using patient-reported information, and whether there are uncommon workflow patterns that arise occasionally but were not observed.

The clinician and office staff survey will be used to collect data regarding attitudes about and perceptions of the health IT workflows staff engage in related to patient-reported information, and the barriers and facilitators associated with capturing and using patient-reported information.

Patients will be interviewed to understand the workflow of entering or reporting information from the patient's perspective, the training required to do so, the time it takes to report information, and whether there are challenges, barriers, facilitators or workarounds commonly used by patients as they report information requested by their care providers.

Follow-up regarding Workflow Process Map(s)

Approximately one month after the site visit, you will be provided with a summary of your current workflow in the form of a process map(s). We will ask you to review the process map(s) and discuss it with us during a one hour phone call.

Finally, after we finish our data analysis, your practice will also be provided with the results of the study for your clinic in particular, and the overall study findings.

Do you have any questions about the study and what it will entail?

If yes, answer questions.

If not or once all questions are answered, thank you for your time and your participation.

- I will send [name of Practice Manager] the Pre-Visit Questionnaire via email at [confirm email address] by [DATE]. We kindly ask you to complete it by [DATE].
- Could you share the project summary with your staff and talk to them about the project?

We will see you on XX/XX for the site visit. If any questions come up in the meantime, feel free to contact me at [phone] or via email at [email address]

Appendix B. Pre-Visit Questionnaire

This is a short questionnaire in preparation for our site visit. In the questionnaire we ask you questions about the socio-technical characteristics of your practice. Socio-technical characteristics include patient or provider characteristics, physical environment and layout, technical training and support, functionality and usability of health IT technologies, worker roles and communication flows.

Please try to answer all of the questions. Your responses will be kept confidential to the extent permitted by law, including Section 944(c) of the Public Health Service Act. 42 U.S.C. 299c-3(c). That law requires that information collected for research conducted or supported by AHRQ that identifies individuals or establishments be used only for the purpose for which it was supplied.

We appreciate the time you are taking to complete this questionnaire and hope that the information will help us better understand how new technology influences people.

Instructions

To answer the questions, check the appropriate box on the scale. For example:

	Never		It varies			Always	
Overall, health IT saves me time.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input checked="" type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇

Some questions will require answers similar to the scale above, while other questions will require different responses. Please try to be as accurate as possible.

Public reporting burden for this collection of information is estimated to average 60 minutes per response, the estimated time required to complete the questionnaire. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to: AHRQ Reports Clearance Officer Attention: PRA, Paperwork Reduction Project (0935-0212) AHRQ, 540 Gaither Road, Room # 5036, Rockville, MD 20850.

1. Name of the physician practice:

General Information on Practice

2. Which of the following best describes the type of practice that characterizes your group practice:

- ☐₁ Multi-specialty
- ☐₂ Single specialty
- ☐₃ Primary care
- ☐₄ Integrated Health System
- ☐₅ Independent Physician Association (IPA)

2. How long has the practice existed? ____ years

3. How many people work in the practice?

a) How many physicians work in the practice?	____ physicians
b) How many mid-level providers (Physician Assistants and Nurse Practitioners) work in the practice?	____ mid-level providers
c) How many nurses work in the practice?	____ nurses
d) How many staff (e.g., receptionist) work in the practice?	____ practice staff

4. Does the practice have IT support? ☐₁ Yes ☐₂ No

a) If yes, in the practice? ☐₁ Yes ☐₂ No

b) If yes, how many IT support staff work in the practice? _____ IT support staff

5. What is the practice size (How many patients do you have?) _____ patients

6. Has there been an increase or decrease in the number of patients in the last 5 years?

- ☐₁ Decrease in patients
- ☐₂ Remained stable
- ☐₃ Increase in patients

7. Who is the owner of the practice?

- ☐₁ Physicians
- ☐₂ Hospital
- ☐₃ Other (insurance, MCO, university, medical school)

8. Have you recently become part of a larger organization? ☐₁ Yes ☐₂ No

Information on health information technology (health IT, such as EHR, e-prescribing, patient portal, e-forms) in the practice

9. Which of the following health IT systems have you implemented in your practice, in what year, and what is the vendor?

Health IT	Yes	Year implemented	Vendor
a) Electronic Health Record (EHR)/ Electronic Medical Record (EMR) (such as Allscripts, EPIC, EHS, Greenway)	<input type="checkbox"/> <input type="checkbox"/> ₁	_____	_____
b) e-prescribing	<input type="checkbox"/> <input type="checkbox"/> ₁	_____	_____
c) Computerized provider order entry (CPOE)	<input type="checkbox"/> <input type="checkbox"/> ₁	_____	_____
d) Patient portal (sometimes referred to as [electronic] personal health records or PHRs; allows patients to view portions of their medical records [e.g., laboratory test results] and supports other health-related tasks such as making appointments or requesting medication refills. Some patient portal applications exist as stand-alone Web sites; other portal applications are integrated into an existing EHR system)	<input type="checkbox"/> <input type="checkbox"/> ₁	_____	_____
e) Secure messaging with patients (use of secure e-mail between patients and clinicians, typically using the secure messaging functionality in the EHR and/or patient portal)	<input type="checkbox"/> <input type="checkbox"/> ₁	_____	_____
f) e-forms (surveys that are administered using computerized media [e.g., tablets, laptops] to collect information from patients using pre-formatted forms before or during patient visits)	<input type="checkbox"/> <input type="checkbox"/> ₁	_____	_____
g) Health information exchange (HIE)	<input type="checkbox"/> <input type="checkbox"/> ₁	_____	_____
h) Internet connection with laboratory facilities	<input type="checkbox"/> <input type="checkbox"/> ₁	_____	_____

Information about health IT implementation

10. Who at the practice was responsible for the implementation of the health IT system at your practice?

11. Before implementing your health IT system, did you prepare for it by finding information about this particular [health IT] implementation? If you did, do you remember what kind of information was most helpful and who provided it?

Please use this box to briefly describe the information. During the interview in the practice, we will ask to provide more detail.

12. Did the practice use resources or guides on how to implement health IT or study the workflow in your practice such as the AHRQ Workflow Assessment for Health IT toolkit (Workflow toolkit) when implementing the health IT system?

☐₁ Yes

☐₂ No

a) If yes, do you remember what tools?

Please use this box to briefly describe the information. During the interview in the practice, we will ask to provide more detail

b) Were these tools helpful? ☐₁ Yes ☐₂ No

c) Did you create any Workflow Process Maps (a Workflow Process Map is a diagram that shows the temporal sequencing of tasks in relation to other components in an organization [person, organization, environment, and tools and technologies]) when implementing the health IT? ☐₁ Yes ☐₂ No

d) If yes, do you have any documentation that shows results of how you studied your work and workflow to prepare for health IT implementation (for example workflow process maps) that you can share with us? ☐₁ Yes ☐₂ No

Relationship practice and hospital

13. Does your practice belong to a larger organization such as an integrated health care system?

☐₁ Yes

☐₂ No (skip to question 14)

If yes, does the larger organization you are part of, provide you with support for:

a) Health IT implementation

☐₁ Yes

☐₂ No

b) Redesigning your workflows

☐₁ Yes

☐₂ No

c) Health IT support (e.g., help desk)

☐₁ Yes

☐₂ No

14. Did the practice receive support when you were implementing your health IT system?

☐₁ Yes

☐₂ No

a) If yes, from whom?

☐₁ Vendor

☐₁ Regional Extension Center (REC)

☐₃ Quality Improvement Organization (QIO) [A QIO is an association of practicing doctors and other health care experts, who work to improve the quality of health care in communities across America. QIQ monitors appropriateness, effectiveness, and quality of care provided to Medicare patients. They work under the U.S. Centers for Medicare and Medicaid Services (CMS) and are represented nationally by the American Health Quality Association.]

☐₄ Other...☐

Health IT and Practice Redesign

15. Was the health IT implemented as part of a practice redesign effort? ☐ ☐₁ Yes

☐₂ No

Health IT satisfaction

16. How satisfied are you with the following health IT?

	Very dissatisfied	Dissatisfied	Neither	Satisfied	Very satisfied	Not Applicable
a) Electronic Health Record (EHR)/Electronic Medical Record (EMR)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆
b) e-Prescribing	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆
c) Computerized Provider Order Entry (CPOE)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆
d) Patient Portal	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆
e) Secure messaging	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆
f) e-forms	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆
g) Health Information Exchange (HIE)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆
h) Internet connection with labs	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆

Thank you for your participation!

Appendix C. Site Visit Schedule Clinic 1

	Start time	Interviewer 1	Interviewer 2	Interviewer 3	Interviewer 4
Tuesday, October 22, 2013	8:30 AM	8:30-9 am, demonstration of migraine e-form software (with MD1 and MA1), MD1's office			
	9:00 AM	9-10 am, interview with clinic manager, her office			
	9:30 AM				
	10:00 AM	10-11 am, interview with physician leader, his office			
	10:30 AM				
	11:00 AM	11-11:30, clinic tour with clinic manager			
	11:30 AM	11:30-1 pm, lunch and debriefing			
	12:00 PM				
	12:30 PM				
	1:00 PM	1-3 pm, interview/observation with MD2, her office	1-3 pm, interview/observation with RN1 at RN's workstation		
	1:30 PM				
	2:00 PM				
	2:30 PM				
	3:00 PM	3-4:30 pm, debriefing			
	3:30 PM				
4:00 PM					

Wednesday, October 23, 2013	Start time	Interviewer 1	Interviewer 2	Interviewer 3	Interviewer 4
	8:30 AM				
	9:00 AM	9-10 am, interview/ observation with scheduler1, front desk	9-11:30 am, interview/observation with MD1, his office	9-10 am, interview/ observation with scheduler1, front desk	
	9:30 AM				
	10:00 AM			10-11 am, interview/ observation with scheduler2, front desk	
	10:30 AM				
	11:00 AM				
	11:30 AM		11:30-12:30, interview/observation with MA2, her workstation	11:30 am-12:30 pm, interview/ observation with scheduler3, front desk	
	12:00 PM				
	12:30 PM		12:30-2pm: lunch and debriefing		
	1:00 PM				
	1:30 PM				
	2:00 PM			2-4 pm, interview/ observation with PA1, her office	
	2:30 PM		2:45-4:45 pm, interview/observation with MD3, his office		
	3:00 PM				
	3:30 PM				
	4:00 PM				
	4:30 PM				
	5:00 PM		5-6 pm, debriefing		
5:30 PM					

	Start time	Interviewer 1	Interviewer 2	Interviewer 3	Interviewer 4
Thursday, October 24, 2013	8:00 AM			8-5 pm, interviews with patients	
	8:30 AM				
	9:00 AM		9-11 am interview/ observation with LPN1, her workstation		9-11 am interview/ observation with LPN1, her workstation
	9:30 AM				
	10:00 AM				
	10:30 AM				
	11:00 AM		11 am-12 pm, lunch break		11 am-12 pm, lunch break
	11:30 AM				
	12:00 PM		12-2 pm, interview/ observation with RN2, her workstation		12-1 pm, interview/ observation with MA2, her workstation
	12:30 PM				
	1:00 PM				
	1:30 PM				
	2:00 PM				
	2:30 PM	2:30-4:30 pm, interview/observation with MD4, his office			
	3:00 PM				
	3:30 PM				
	4:00 PM				
4:30 PM					
5:00 PM					
5:30 PM	5-6 pm, debriefing				

	Start time	Interviewer 1	Interviewer 2	Interviewer 3	Interviewer 4
Friday, October 25, 2013	8:00 AM				
	8:30 AM				
	9:00 AM		9-11 am, interview/ observation with PA2, his office		9-11 am, interview/ observation with RN3, her workstation
	9:30 AM				
	10:00 AM			10-11 am, interview/ observation with MA3, her workstation	
	10:30 AM				
	11:00 AM		Travel		
	11:30 AM		Lunch break		
	12:00 PM				
	12:30 PM	12:30-2:30 pm, debriefing			
	1:00 PM				
	1:30 PM				
2:00 PM					

Appendix D. Site Visit Schedule Clinic 2

	Start time	Interviewer 1	Interviewer 2
Wednesday, January 8, 2014	8:00 AM		
	8:30 AM		
	9:00 AM	9-9:30 am, tour of clinic, meet staff	
	9:30 AM	9:30-10:30 am, demonstration of Bizmatics Prognosis software, clinic manager's office	
	10:00 AM		
	10:30 AM	10:30-11:30, interview with clinic manager	
	11:00 AM	11:30 am-1 pm, lunch break and debriefing	
	11:30 AM		
	12:00 PM		
	12:30 PM	1-2:30, interview and observation with MA	
	1:00 PM		
	1:30 PM		
	2:00 PM		
	2:30 PM		
	3:00 PM	2:30-5:30 pm, interview and observation with MD	
	3:30 PM		
	4:00 PM		
	4:30 PM		
	5:00 PM		
	5:30 PM		
	6:00 PM		

	Start time	Interviewer 1	Interviewer 2
Thursday, January 9, 2014	8:00 AM	Available to interview patients at any time, otherwise will join Interviewer 2 in doing interviews/observations	
	8:30 AM		
	9:00 AM		9-10:30 am, interview/observation with billing specialist
	9:30 AM		
	10:00 AM		
	10:30 AM		
	11:00 AM		
	11:30 AM		
	12:00 PM		
	12:30 PM		
	1:00 PM		1-2:30 pm, interview/observation with receptionist, front desk
	1:30 PM		
	2:00 PM		
	2:30 PM		
	3:00 PM		
	3:30 PM		
	4:00 PM		
	4:30 PM		
	5:00 PM		
	5:30 PM		

Appendix E. Site Visit Schedule Clinic 3

	Start time	Interviewer 1	Interviewer 2	Interviewer 3	Interviewer 4
Tuesday, February 4, 2014	8:00 AM			8-8:30 am, interview with patient1, conference room	
	8:30 AM		8:30-9 am, tour of clinic with clinic manager		
	9:00 AM		9-11 am, interview/observation with RN1, practice manager and RN		
	9:30 AM				
	10:00 AM				
	10:30 AM				
	11:00 AM		11-12:15 pm, interview/observation with receptionist1	11-12:15, interview with patient2	11-12:15 pm, interview/observation with receptionist1
	11:30 AM				
	12:00 PM		12:15-1:30, lunch break and debriefing		
	12:30 PM				
	1:00 PM				
	1:30 PM		1:30-3 pm, interview/observation with receptionist2	1:30-2:30 pm, interview with patient3	1:30-3:00, interview/observation with MA1
	2:00 PM				
	2:30 PM				
	3:00 PM	3-4 pm, debriefing			
	3:30 PM				
	4:00 PM		4-6, interview and observation with MD1, physician leader		
	4:30 PM				
	5:00 PM				
	5:30 PM				

☐	Start time☐	Interviewer 1☐	Interviewer 2☐	Interviewer 3☐	Interviewer 4☐
Wednesday, February 5, 2014☐	8:00 AM☐	☐	8-10 am, interview/observation with MD2☐	☐	8-10 am, interview/observation with MD2☐
	8:30 AM☐	☐		8:30-10 am, interview/observation with MA2☐	
	9:00 AM☐	☐			
	9:30 AM☐	☐			
	10:00 AM☐	☐	10 am-12 pm, interview/observation with RN2☐		10-11:30 am, interview/observation with RN2☐
	10:30 AM☐	☐			
	11:00 AM☐	☐			
	11:30 AM☐	☐			
	12:00 PM☐	☐	12-1 pm, lunch break and debriefing☐		
	12:30 PM☐	☐			
	1:00 PM☐	☐	1-3 pm, interview/observation with MD3☐	1-2 pm, interview with patient4☐	1-3 pm, interview/observation with MD3☐
	1:30 PM☐	☐		☐	
	2:00 PM☐	☐		☐	
	2:30 PM☐	☐			
	3:00 PM☐	3-4 pm, debriefing☐			
	3:30 PM☐				
	4:00 PM☐	☐	☐	4:4:30, interview with patient5☐	

	Start time	Interviewer 1	Interviewer 2	Interviewer 3	Interviewer 4
Thursday, February 6, 2014	8:00 AM				
	8:30 AM			8:30-9 am, interview with patient6, conference room	
	9:00 AM		9-10 am, interview with physician leader		
	9:30 AM				
	10:00 AM		Travel		
	10:30 AM	10:30-12 pm, debriefing and wrap-up session			
	11:00 AM				
	11:30 AM				
	12:00 PM				
	12:30 PM				
	1:00 PM			1-2 pm, patient interview6	
	1:30 PM				
	2:00 PM				
	2:30 PM			2:30-3:30 pm, possible patient interview	
	3:00 PM				
	3:30 PM				
	4:00 PM				
	4:30 PM			4:30-5 pm, possible patient interview	

Appendix F. Site Visit Schedule Clinic 4

	Start time	Interviewer 1	Interviewer 2	Interviewer 3
Wednesday, April 9, 2014	7:30 AM			
	8:00 AM	8-9:15 am, orientation/review with research team		
	8:30 AM			
	9:00 AM	9:15-9:30 am, travel to clinic		
	9:30 AM	9:30-10 am, tour of clinic		
	10:00 AM	10-11 am, demonstration of e-forms		
	10:30 AM			
	11:00 AM	11-12 pm, interview with Clinic Director		
	11:30 AM			
	12:00 PM	12-1 pm, lunch and debriefing		
	12:30 PM			
	1:00 PM	1-2:30 pm, interview/observation with RN1		1-2:30 pm, observation with MD1 and MD2
	1:30 PM			
	2:00 PM			
	2:30 PM			2:30-4 pm, interviews with patients
	3:00 PM	3-4 pm, interview with NP1		
	3:30 PM			
	4:00 PM	4-5 pm, debriefing		
	4:30 PM			
	5:00 PM	5-6 pm, interview with MD1		5-6 pm, interview with MD2
	5:30 PM			

	Start time	Interviewer 1	Interviewer 2	Interviewer 3
Thursday, April 10, 2014	8:00 AM		8-9:30 am, observation with SW1	
	8:30 AM			
	9:00 AM			
	9:30 AM		9:30-10 am, observation of receptionists	
	10:00 AM	10-11:30 am, observation with NP2 and MD4	10-10:30 am, interview with receptionist1	
	10:30 AM		10:30-11 am, interview with receptionist2	
	11:00 AM			11-1 pm, interviews with patients
	11:30 AM			
	12:00 PM	12-1 pm, interview with NP2		
	12:30 PM			
	1:00 PM	1-2 pm, lunch		
	1:30 PM			
	2:00 PM	2-3:30 pm, observation with SW2		2-3 pm, interview/ observation with MA1
	2:30 PM			3-5 pm, interviews with patients
	3:00 PM			
	3:30 PM	3:30-5 pm, interviews with patients,	3:30-5 pm, observation with MD3 and NP3	
	4:00 PM			
	4:30 PM			
	5:00 PM	5-6 pm, interview with MD3		
	5:30 PM			
	6:00 PM	6-6:30, debriefing		

	Start time	Interviewer 1	Interviewer 2	Interviewer 3
Friday, April 11, 2014	8:00 AM	8-9 am, interview with MD4		8-9 am, interviews with patients
	8:30 AM			
	9:00 AM	9-10 am, interview with physician leader		
	9:30 AM			
	10:00 AM	10-11:30 am, interview/ observation with RN2	10-11 am, interview/observation with MA2	
	10:30 AM		11-12, interview with MD5	
	11:00 AM			
	11:30 AM			
	12:00 PM	Post clinic (12-1) interview with MD6		
	12:30 PM		12:30-1:30, lunch	
	1:00 PM	1-2 pm, lunch	1:30-2:30 pm, interview with SW2	
	1:30 PM			
	2:00 PM			
	2:30 PM			2:30-5pm, interviews with patients
	3:00 PM	3-4 pm, interview with NP3		
	3:30 PM			
	4:00 PM			
	4:30 PM			
	5:00 PM	5-5:30 debriefing		
	5:30 PM			

Appendix G. Site Visit Schedule Clinic 5

	Start time	Interviewer 1	Interviewer 2	Interviewer 3
Tuesday, May 20, 2014	8:00 AM			
	8:30 AM	8:30-9 am, clinic tour with clinic manager		
	9:00 AM	9-10 am, interview with clinic manager		
	9:30 AM			
	10:00 AM			
	10:30 AM			
	11:00 AM		11 am-12 pm, interview with RN1	
	11:30 AM			
	12:00 PM	12-1 pm, lunch and debriefing		
	12:30 PM			
	1:00 PM			1-4 pm, patient interviews
	1:30 PM			
	2:00 PM	2-3 pm, observation of schedulers		
	2:30 PM			
	3:00 PM	3-4 pm, interview with scheduler1		
	3:30 PM			
	4:00 PM	4-4:30 pm, debriefing		
	4:30 PM			
	5:00 PM			
		5:15-7:15 pm, observation/interview with MD1, his office		
	5:30 PM			
	6:00 PM			
	6:30 PM			
	7:00 PM			

	Start time	Interviewer 1	Interviewer 2	Interviewer 3
Wednesday, May 21, 2014	8:00 AM			
	8:30 AM	8:30-9:30 am, interview with physician leader, his office		
	9:00 AM			
	9:30 AM	9:30-10:30 am, observation of RNs		
	10:00 AM			
	10:30 AM			
	11:00 AM			11 am-12 pm, interview with RN2
	11:30 AM	Lunch		
	12:00 PM			12-1 pm, observation/interview with RN3
	12:30 PM	12:30-2 pm, observation/interview with MD2		
	1:00 PM			1-4:30 pm, patient interviews
	1:30 PM			
	2:00 PM			
	2:30 PM			
	3:00 PM			
	3:30 PM			
4:00 PM				

Thursday, May 22, 2014	Start time	Interviewer 1	Interviewer 2	Interviewer 3	
	8:00 AM	8-10 am, observation/interview with MD3			
	8:30 AM				
	9:00 AM			9-10:30 am, observation/interview with MD4	
	9:30 AM				
	10:00 AM			10:30-12, patient interviews	
	10:30 AM				
	11:00 AM	11 am-12 pm, interview with RN4			
	11:30 AM				
	12:00 PM	Lunch			
	12:30 PM				
	1:00 PM	1-2 pm, observation/interview with RN5		1-4:30, patient interviews	
	1:30 PM				
	2:00 PM				
	2:30 PM	2:30-3:30, interview with scheduler2			
	3:00 PM	3:30-4:30, debriefing			
	3:30 PM				
	4:00 PM				
	4:30 PM				
	5:00 PM				
	5:30 PM	5:15-6:45, observation/interview with MD5			
	6:00 PM				
6:30 PM					

Appendix H. Site Visit Schedule Clinic 6

	Start time	Interviewer 1	Interviewer 2
Monday June 2, 2014	8:00 AM		
	8:30 AM	8:30-9 am, clinic tour with clinic manager	
	9:00 AM	9-10 am, interview with clinic manager	
	9:30 AM		
	10:00 AM		
	10:30 AM	10:30-12 pm, observation/interview with NP1	
	11:00 AM		
	11:30 AM		
	12:00 PM	12-1:30 pm: lunch and debriefing	
	12:30 PM		
	1:00 PM		
	1:30 PM	1:30-2:30 interview with RN1	
	2:00 PM		
	2:30 PM		
	3:00 PM	3-4:30 observation/interview with MD1	
	3:30 PM		
	4:00 PM		
	4:30 PM		
	5:00 PM		

	Start time	Interviewer 1	Interviewer 2		
Tuesday June 3, 2014	8:00 AM	8-9 am, observe RN triage pool			
	8:30 AM				
	9:00 AM	9-12 pm, patient interviews			
	9:30 AM			9:30-10:30 am, interview with RN2	
	10:00 AM				
	10:30 AM				
	11:00 AM				
	11:30 AM				
	12:00 PM	Lunch			
	12:30 PM				
	1:00 PM	1-2 pm, interview with physician leader			
	1:30 PM				
	2:00 PM				
	2:30 PM	2:30-3:30, debriefing			
	3:00 PM				
	3:30 PM	3:30-5 pm, patient interviews			
	4:00 PM				
	4:30 PM				
	5:00 PM				

	Start time	Interviewer 1	Interviewer 2
Wednesday June 4, 2014	8:00 AM		
	8:30 AM	8:30-9:30, interview with RN3	
	9:00 AM		
	9:30 AM		
	10:00 AM	10-11:30 am, interview with MD2	
	10:30 AM		
	11:00 AM		
	11:30 AM	11:30-12 pm, debriefing	
	12:00 PM		12-5 pm, patient interviews
	12:30 PM		
	1:00 PM		
	1:30 PM		
	2:00 PM		
	2:30 PM		
	3:00 PM		
	3:30 PM		
	4:00 PM		
	4:30 PM		
	5:00 PM		

Appendix I. Practice Tour Guide

Practice Tour Guide

Observer/Interviewer instructions: Please focus on the use of health IT, in particular how the practice uses patient-reported information, and how it impacts the workflow in the practice and in the different phases of a patient visit to his/her doctor. Note whether it affects the environment; the people, and the tasks they perform; and possible changes to the organization of work. Also note what tools and technology are involved.

Can you please walk us through a patient visit in the practice?

During the walk-through, can you explain what different kinds of *health IT you use and, in particular, health IT that patients can use to provide information or communicate with their care team?*

Let's start with the reception, then the intake and waiting room and, finally, the exam rooms. While we do the tour, can you please describe how health IT is used and, in particular, health IT that allows patients to provide medical or health information?

- Do you use ***patient portals*** (sometimes referred to as [electronic] personal health records or PHRs; allow patients to view portions of their medical records [e.g., laboratory test results] and support other health-related tasks such as making appointments or requesting medication refills. Some patient portal applications exist as stand-alone Web sites; other portal applications are integrated into an existing electronic health record [EHR] system) in your practice?
- If yes:
 - How do patient portals fit in the patient's journey? (What happens with information? How is it used?)
 - How do patient portals affect the workflow of the employees in your practice?
- Do you use ***secure messaging*** with patients (use of secure e-mail between patients and clinicians, typically using the secure messaging functionality in the EHR and/or patient portal) in your practice?
- If yes:
 - How does secure messaging fit in the patient's journey? (What happens with information? How is it used?)
 - How does secure messaging affect the workflow of the employees in your practice?

Public reporting burden for this collection of information is estimated to average 60 minutes per response, the estimated time required to complete the tour. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to: AHRQ Reports Clearance Officer Attention: PRA, Paperwork Reduction Project (0935-0212) AHRQ, 540 Gaither Road, Room # 5036, Rockville, MD 20850.

- Do you use *e-forms* (surveys that are administered using computerized media [e.g., tablets, laptops] to collect information from patients using pre-formatted forms before or during patient visits) in your practice?
- If yes:
 - How do e-forms fit in the general patient journey? (What happens with information? How is it used?)
 - How do e-forms they affect the workflow of the people in the practice?

Many thanks for your cooperation!

Appendix J. Summary of Interview and Observation Data

	Clinic 1	Clinic 2	Clinic 3	Clinic 4	Clinic 5	Clinic 6	Total
Interviews							
Clinic manager	1 1:05	1 2:25	0	1 0:58	1 1:00	1 1:11	5 6:39
Physician leader	1 1:01	0	0	1 0:51	1 0:52	1 1:05	4 3:49
Patient	6 1:34	5 1:16	6 1:10	6 1:04	7 1:44	3 0:32	33 7:20
Interviews conducted concurrently with observations							
Physician	4 6:34	1 1:50	3 1:55	5 5:16	5 5:14	2 2:05	20 22:54
PA or NP	2 3:23	0	0	3 5:20	0	1 0:33	6 9:16
Nurse	5 6:31	0	2 2:20	2 1:08	6 4:36	3 2:29	18 17:04
MA	3 2:52	1 0:46	2 1:43	2 1:25	0	0	8 6:46
Receptionist or scheduler	3 2:45	1 0:50	0 0:00	2 0:46	1 1:10	0	7 5:31
Other staff	0	1 0:40	0	2 2:12	0	0	3 2:52
Observations							
Provider	0	0	0	3 4:20	0	0	3 4:20
Nurse	0	0	0	0	0	1 1:20	1 1:20
Receptionist or scheduler	0	0	1 0:45	1 0:30	0	0	2 1:15
Total	25 25:45	10 7:47	14 7:53	28 23:50	21 14:36	12 9:15	110 89:06

Appendix K. Guide for Interview with Clinic Manager

Thank you for participating in the study today. The goal of the study is to understand the influence of things such as patient or provider characteristics; physical environment and layout; technical training and support; functionality and usability of health IT; worker roles; staff workload, stress, and job satisfaction; and communication flows—in capturing and using patient-reported information in ambulatory health IT systems and associated workflows.

Your participation includes an interview where we will ask you questions about the use of health IT to record patient-reported information, such as symptoms (e.g., pain, fatigue), results of self-testing (e.g., blood glucose levels, blood pressure), weight questions and concerns, or over-the-counter medication use, and its impact on workflow. In this interview we will ask you some questions about the social context (the people that work in the practice, your patients, and the way work is organized in your practice); and during the interview with the Physician Leader we will focus on the technical context and, in particular, the health information technology (IT) used in your practice.

First we need to review an information sheet describing the study.

[Give subject copy of information sheet and review it with them].

Please read the sheet carefully. If you still would like to participate in the interview, please let me know. Do you have any questions before we move on?

[After respondent agrees to participate]

Thank you again for agreeing to participate in the study today. As I mentioned before, the goal of the study is to help us understand factors that influence how your practice captures and uses patient-reported information in health IT systems and associated workflows. We are interested in characteristics of your practice and how it is organized, who is involved in capturing and using patient-reported information, the tools and technology people use to accomplish their tasks, the workflow across individuals in your practice, and variation or flexibility in individuals' workflows. We would like to audio-record the interview to help us capture your responses. May we record the interview?

Public reporting burden for this collection of information is estimated to average 60 minutes per response, the estimated time required to complete the interview. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to: AHRQ Reports Clearance Officer Attention: PRA, Paperwork Reduction Project (0935-0212) AHRQ, 540 Gaither Road, Room # 5036, Rockville, MD 20850.

- *If subject has agreed to audio-recording:*
I have set up the tape recorder here in front of us. Please speak clearly during the interview so that the tape will record your voice accurately. I may ask you to repeat a response to make sure that it is recorded.

- *If subject has not agreed to audio recording and a note taker is not available:*
I will take notes during our conversation today. I may ask you to slow down or pause for a moment so that I can record what you say accurately.
- *If subject has not agreed to audio recording and a note taker is available:*
My colleague [NAME] will take notes during our conversation today. He/she may ask you to slow down or pause for a moment so that he/she can record what you say accurately.

During the interview, please use only your first name if you refer to yourself. This will help us keep your responses private. Your answers will not be individually reported to your care team members here at the practice. If we do share information from the interview with practice staff, we will only report it at the aggregate level, so that it is not obvious who said what.

The interview will take about 60 minutes to complete. If you need to take a break during the interview to use the restroom or get a drink, please let me know and we will pause the interview.

If any of my questions aren't clear or you don't understand a word that I use, please let me know and I will rephrase the question for you.

Please remember that you are not required to answer any specific question. You may also leave the interview at any time.

Do you have any questions before we start the interview?

I. PRACTICE CHARACTERISTICS

1. Practice History and Current Status

Please tell us a little bit about the history of the practice. For example, how has the practice developed over time?

2. Patients

Can you tell us about the patients that come for care in your practice? For example, do you have many Medicaid/Medicare patients? Do you have many patients with chronic diseases? Do you have many patients that use information technology (e.g., computers, smart phones, tablet computers)?

3. Organization of Work

Can you tell us a bit about how work is organized in your practice? For example, can you tell us about the different job positions (e.g. receptionist(s), clerks, medical assistants, nurses, physician assistant, nurse practitioners, and physicians) and what they do?

4. Health IT and Organization of Work

Can you tell us something about the impact of health IT and, in particular, health IT that is used by patients to provide information? These types of health IT systems can include:

- Patient portals (sometimes referred to as [electronic] personal health records or PHRs; allow patients to view portions of their medical records [e.g., laboratory test results] and support other health-related tasks such as making appointments or requesting medication refills. Some patient portal applications exist as stand-alone Web sites; other portal applications are integrated into an existing electronic health record [EHR] system);
- Secure messaging with patients (use of secure e-mail between patients and clinicians, typically using the secure messaging functionality in the EHR and/or patient portal); and
- e-forms (surveys that are administered using computerized media [e.g., tablets, laptops] to collect information from patients using pre-formatted forms before or during patient visits).

What is the impact of these technologies on the practice? What effect does it have on the way work is organized in the practice? Does it affect workflow? How does it affect the billing process?

5. Patients and Health IT

Can you tell us something about how patients in your practice use health IT, such as secure messaging to ask questions? Can you tell us some more about patients' use of health IT? Are there certain types of patients that use health IT more than others (e.g., young, computer savvy patients, or patients with chronic diseases)?

II. IMPACT OF HEALTH IT ON YOUR PRACTICE

The following questions are about the implementation of health IT and, in particular, health IT that allows patients to provide information electronically, (such as e-forms, , secure messaging, and patient portals, and what impact that has on way you organize the work in your practice.

1. Changes with regard to the (physical) environment

- What changes did [health IT] implementation create for your *work environment*?
 - Do clinicians and staff have less paper to deal with?
 - Do clinicians and staff spend more time with computers?
 - For example, do clinicians and staff in the practice spend more time dealing with other people (colleagues and patients) using the computer, instead of talking to them face-to-face or via the phone?
 - Do they have to walk less, or more?
 - Are computer work stations located where they spend most time?

- ➔ **Interactions:** Did changes in the physical environment cause changes in the way work is organized?
- ➔ **Interactions:** Did changes in the physical environment cause changes in the way tasks are performed?
- ➔ **Interactions:** Did changes in the physical environment cause changes in the way clinicians and staff interact with other people (colleagues and patients)?

2. Changes with regard to the person(s)

- Did clinicians and staff receive (extensive) training in the use of [health IT]?
- Are there changes in the way clinicians and staff in the practice perform their work? For example:
 - Who takes care of [health IT] in the practice?
 - Who customizes [health IT]?
 - Can clinicians and staff –as the end-users- make changes to the [health IT], to better fit their workflow?
- ➔ **Interactions:** Based on your experience, did these changes have an impact on the rest of the practice? For example, do you think that better trained personnel interact differently with their colleagues and with patients?

3. Changes with regard to tasks you perform

- What activities do clinicians and staff do now (with [health IT]) that they did not do before (when you used a paper system)?
 - Do clinicians and staff spend more on certain tasks than before [health IT] implementation?
 - For example, do physicians spend more or less time examining the patient? Talking with the patient? Please explain.
 - Do clinicians talk about different things when patients come for office visits? For example, less time asking about history and current problems and more time talking about a care plan? Please explain.
 - Do clinicians and staff spend time now helping patients use the [health IT] to report information? For example, showing them how to use a tablet computer, or explaining how to use the patient portal?
 - Do you think that –overall– [health IT] saves you time?
 - Does [health IT] help clinicians and staff to better prepare for a patient's visit?
- ➔ **Interactions:** What effects have these changes in tasks on how you organize the work in your practice and workflow?

4. Changes with regard to tools and technology

- How did [health IT] implementation change the way clinicians and staff use *tools and technology, such as the telephone, fax, and computers*?
 - Do clinicians and staff use certain tools and technology less? More?
 - For example, do clinicians and staff use the phone less, now that patients can send information electronically, or use secure messaging to ask questions?
 - Do clinicians and staff spend more time answering email now?
 - Do clinicians and staff help patients use tablet computers or other technology to report their information?
 - Does information come from a patient **Web site** to you? How does it arrive: directly into the patient's electronic record, or via an email?
 - Do clinicians and staff spend more/less time looking for patient information (as compared to paper charts)?
 - Do clinicians and staff spend more/less time passing information back and forth with others in your practice, or waiting for someone else to finish with a chart before they can use it?
 - How do practice clinicians and staff use [health IT] to communicate with your patients?
 - What kind of topics do clinicians discuss with patients using [health IT]?
 - Immediate health concerns?
 - General health issues such as lifestyle changes?
 - Patient self-monitoring/self-management?
 - Medication questions?
 - Test results?
 - Specialist referrals?
 - Prescription refills?
 - Scheduling appointments?
 - Does your practice examine/analyze the use of data from [health IT]? In other words: do you analyze:
 - How many patients have used the [health IT]?
 - How much time you have spent using the [health IT],
 - What effect has it had on patient visits, calls, etc.
 - How does your practice use the [health IT] to redesign your workflow and improve quality of care?
 - Do you think that “automation” of certain processes allows clinicians and staff to spend more time on patients?
- ➔ **Interactions:** Has the way you changed your use of tools and technology impacted the tasks that clinicians and staff do and the way the work is organized?

5. Changes with regard to the organization of the practice

General questions:

- How has [health IT] affected the organizational structure of the practice? For example, new people hired, such as medical assistants.
- How has [health IT] affected the *processes* in the practice? Do people do other things and do people spend their time differently?

Specific questions:

- How has [health IT] implementation affected the number of patient visits?
- How has [health IT] implementation affected the length of patient visits?
- On average, how many patients report information to the practice using [health IT]?
 - Per day
 - Per week
- What percent of all your patients use [health IT] on a regular basis?
- How does [health IT] affect appointment scheduling? For example, longer or shorter patient visits.
- Does [health IT] implementation affect the number of patients you see per day?
- How does [health IT] affect referrals?
- How does [health IT] affect information about test results? For example, do patients have questions about the test results that show up in the patient portal??
- How does [health IT] affect prescription changes and medication monitoring/management?
- What can you tell us about *efficiency* of your practice after [health IT] implementation? Do you feel that processes are more efficient, for example physicians are able to see more patients per day?
- Do you use [health IT] for activities such as preventive screening and patient education?
- Does [health IT] impact how you measure quality of care provided?

➔ **Interactions:** What are the consequences of these organizational changes for the practice?

➔ **Interactions:** Does it affect the tasks that people perform?

6. Use of [health IT] in daily practice

- How does [health IT] affect workflow?
 - For example, when do clinicians and staff check e-mail?
 - How many times a day?
 - When do clinicians and staff reply to patient's e-mail? Is that structured (in other words: at certain times) or is it ad hoc (whenever they can find the time)?
 - Does triage of the e-mails take place? How do clinicians and staff make decisions with regard to triage?
 - How do clinicians and staff manage communication to other clinicians (how do you prevent the information becoming too unwieldy)?

- Do you use scripted templates in your practice?
 - How do clinicians and staff decide whether a patient can be “seen” via e-mail, or should instead be invited to make a practice appointment?
- How does [health IT] affect workload in your practice?
- How does [health IT] affect communication in your practice?
- Have you had any problems using [health IT] to communicate with patients? Can you give us an example?

7. Usefulness and usability of [health IT]

- What do you think about the *usefulness* and potential benefits of [health it]? Does health IT have benefits?
 - Is it useful for your practice?
 - Is it useful for patients?
 - Does it help you redesign your practice in such a way that you have become more efficient or more effective? Please explain.
- What do you think of *usability* of [health IT]?
 - Is it easy or practice clinicians and staff?
 - Is it easy to use for patients?
- What part(s) of [health IT] do you like best?
- What part(s) of [health IT] could be improved?

8. [Health IT] implementation and practice redesign

- Does [health IT] implementation provide you with opportunities to redesign your work and workflow? Can you please provide some examples?
- Does [health IT] make the processes more efficient?
- Does [health IT] allow you to spend more time on the direct care activities, the “core processes” of your practice, such as patient examination, patient communication. Can you provide some examples?

9. [Health IT] implementation and quality and safety of patient care

- How do you think that [health IT] affects quality of care?
- How does [health IT] affect continuity of care? For example, does [health IT] allow you to examine trends in patient data, or send out reminders?
- How do you think that [health IT] affects patient involvement?
- How do you think that [health IT] affects patient participation in decisionmaking?
- What effect does [health IT] have on patient adherence? Patient self-management?
- How do you think that [health IT] affects care coordination?
- How do you think that [health IT] affects patient safety?
 - Do you think [health IT] reduces medical errors?
 - If yes, why? If no, why not?

10. Security and privacy

- What do you think about security, privacy, and confidentiality and [health IT]?
- How much of an issue is this for you?
- How much of an issue is it for patients, do you think?

11. [Health IT] implementation and patient satisfaction

- How do you think that patients appreciate the practice's use of [health IT]?
- Do some patients benefit more from [health IT] than others (e.g., patients with chronic care needs)?

12. Barriers

- What are the main barriers to successful [health IT] implementation?
 - Start-up costs
 - Maintenance costs
 - Reimbursement for time spent using [health IT]
 - Privacy, security
 - Privacy and security concerns of patients
 - Computer skills of you and your colleagues
 - Computer skills of patients
 - Workflow adjustments
 - Training
 - Skepticism
 - Increase in workload
 - Lack of computer support in your workplace
 - Lack of computer support (or hardware, internet access) for patients
 - Legal risks
 - Loss of face-to-face contact with patients
 - Negative effect on patient-physician communication
 - Other ...
- Which, of all those barriers, do you think is the most important one?

13. Facilitators

- Does [health IT] make your life easier? If yes, why, If no, why not?
- Does [health IT] improve the processes in the practice?
- Do you use data from your [health IT] to (further) improve/redesign your practice?
- Do you think [health IT] makes life easier for patients? If yes, why? If no, why not?
- Do you think that patients who use health IT and provide information, are better prepared when they come to the practice?

14. Final questions

- Overall, how satisfied are you with [health IT] in your practice?

Appendix L. Guide for Interview with Physician Leader

Secure Messaging

Guide for Interview with Physician Leader

Day of interview: _____

Gender: ☐ Male ☐ Female

Time of interview: Beginning: _____ End: _____

Total duration of interview: _____

Interviewers (circle initials): PC PH RSC DD

Thank you for participating in the study today. The goal of the study is to understand the influence of things such as patient or provider characteristics; physical environment and layout; technical training and support; functionality and usability of health IT; worker roles; staff workload, stress, and job satisfaction; and communication flows—in capturing and using patient-reported information in ambulatory health IT systems and associated workflows.

Your participation includes an interview where we will ask you questions about the use of health IT to record patient-reported information, such as symptoms (e.g., pain, fatigue), results of self-testing (e.g., blood glucose levels, blood pressure), weight questions and concerns, or over-the-counter medication use, and its impact on workflow. In this interview we will focus on the technological context and ask you some questions, the health information technology (IT) used in your practice. During the interview with the Practice Manager we will focus on the social context (e.g., history and background of the practice, patient population you serve).

First we need to review an information sheet describing the study.

[Give subject copy of information sheet and review it with them].

Please read the sheet carefully. If you still would like to participate in the interview, please let me know. Do you have any questions before we move on?

[After respondent agrees to participate]

Thank you again for agreeing to participate in the study today. As I mentioned before, the goal of the study is to understand factors that influence how your practice captures and uses patient-reported information in health IT systems and associated workflows. We are interested in the tools and technologies used in your practice, and the workflows for clinicians when incorporating patient-reported information into their interactions with patients and clinical decisionmaking. We would like to audio-record the interview to help us capture your responses. May we record the interview?

Public reporting burden for this collection of information is estimated to average 60 minutes per response, the estimated time required to complete the interview. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to: AHRQ Reports Clearance Officer Attention: PRA, Paperwork Reduction Project (0935-0212) AHRQ, 540 Gaither Road, Room # 5036, Rockville, MD 20850.

- If subject has agreed to audio-recording:

I have set up the tape recorder here in front of us. Please speak clearly during the interview so that the tape will record your voice accurately. I may ask you to repeat a response to make sure that it is recorded.

- If subject has not agreed to audio recording and a note taker is not available:

I will take notes during our conversation today. I may ask you to slow down or pause for a moment so that I can record what you say accurately.

- If subject has not agreed to audio recording and a note taker is available:

My colleague [NAME] will take notes during our conversation today. He/she may ask you to slow down or pause for a moment so that he/she can record what you say accurately.

During the interview, please use only your first name if you refer to yourself. This will help us keep your responses private. Your answers will not be individually reported to your care team members here at the practice. If we do share information from the interview with practice staff, we will only report it at the aggregate level, so that it is not obvious who said what.

The interview will take about 60 minutes to complete. If you need to take a break during the interview to use the restroom or get a drink, please let me know and we will pause the interview.

If any of my questions aren't clear or you don't understand a word that I use, please let me know and I will rephrase the question for you.

Please remember that you are not required to answer any specific question. You may also leave the interview at any time.

Do you have any questions before we start the interview?

III. HISTORY OF AND CURRENT STATUS OF HEALTH INFORMATION TECHNOLOGY

- ☐ When did you implement your electronic health record (EHR) system?
 - ☐ What functionalities does it have (e.g. e-prescribing, computerized provider order entry [CPOE], computer decision support [CDS])?
- ☐ Can you tell us about the implementation process?
 - ☐ How did you implement it? For example how did you choose your current EHR?
 - ☐ What sorts of help did you receive from another organization with your health IT implementation (for example a Regional Extension Center [REC] or a Quality Improvement Organization [QIO])?
 - ☐ Was the implementation process easy?
 - ☐ What difficulties did you have? Can you give us some examples?

IV. HEALTH IT SUPPORT

- ☐ What kind of health IT support do you have in your practice?
 - ☐ Did you hire IT personnel?
 - ☐ Are you satisfied with the health IT support that you have in your practice?
- ☐ Can you tell us about health IT in your practice that collects information from patients? These types of health IT systems can include:
 - ☐ Secure messaging with patients
 - ☐ E-forms.
- ☐ When did you implement this (these) system(s)?
 - ☐ Did someone help you with the implementation?
 - ☐ Was the implementation process easy? What difficulties did you have?
 - ☐ What do you do with the information that patients provide?
 - ☐ Does patient-provided information have a big impact on the way you organize your work in then practice? And on workflow?

V. FUTURE HEALTH IT PLANS

- ☐ What are the future plans with regard to health IT?

➔ IV. IMPACT OF SECURE MESSAGING ON YOUR PRACTICE

VI. IMPACT OF SECURE MESSAGING ON YOUR PRACTICE

The following questions are about the implementation of secure messaging and what impact that has on way you organize the work in your practice.

1. Use of secure messaging in daily practice

- ☐ How does secure messaging affect workflow?
 - ☐ For example, when do clinicians and staff check e-mail?
 - ☐ How many times a day?
 - ☐ When do clinicians and staff reply to patient's e-mail? Is that structured (in other words: at certain times) or is it ad hoc (whenever they can find the time)?
 - ☐ Does triage of the e-mails take place? How do clinicians and staff make decisions with regard to triage?
 - ☐ How do clinicians and staff manage communication to other clinicians (how do you prevent the information becoming too unwieldy)?
 - ☐ Do you use scripted templates in your practice?
 - ☐ How do clinicians and staff decide whether a patient can be "seen" via e-mail, or should instead be invited to make a practice appointment?
- ☐ How does secure messaging affect workload in your practice?
- ☐ How does secure messaging affect communication in your practice?
- ☐ Have you had any problems using secure messaging to communicate with patients? Can you give us an example?

2. Changes with regard to tasks you perform

- What activities do clinicians and staff do now (with secure messaging) that they did not do before (when you used a paper system)?
 - ☐ Do clinicians and staff spend more on certain tasks than before the implementation of secure messaging?
 - ☐ For example, do physicians spend more or less time examining the patient? Talking with the patient? Please explain.
 - ☐ Do clinicians talk about different things when patients come for office visits? For example, less time asking about history and current problems and more time talking about a care plan? Please explain.
 - ☐ Do clinicians and staff spend time now helping patients use the secure messaging to report information? For example, explaining how to use MyChart?
 - ☐ Do you think that –overall– secure messaging saves you time?
 - ☐ Does secure messaging help clinicians and staff to better prepare for a patient's visit?

➔ **Interactions:** What effects have these changes in tasks on how you organize the work in your practice and workflow?

3. Usefulness and usability of secure messaging

- ☐ What do you think about the *usefulness* and potential benefits of secure messaging? Does secure messaging have benefits?
 - ☐ Is it useful for your practice?
 - ☐ Is it useful for patients?
 - ☐ Does it help you redesign your practice in such a way that you have become more efficient or more effective? Please explain.
- ☐ What do you think of *usability* of secure messaging?
 - ☐ Is it easy for practice clinicians and staff?
 - ☐ Is it easy to use for patients?
- ☐ What part(s) of secure messaging do you like best?
- ☐ What part(s) of secure messaging could be improved?

4. Changes with regard to tools and technology

- How did the implementation of secure messaging change the way clinicians and staff use *tools and technology, such as the telephone, fax, and computers*?
 - Do clinicians and staff use certain tools and technology less? More?
 - For example, do clinicians and staff use the phone less, now that patients can send information electronically, or use secure messaging to ask questions?
 - Do clinicians and staff spend more time answering email now?
 - Do clinicians and staff help patients use computers or other technology to report their information?
 - Do clinicians and staff spend more/less time looking for patient information (as compared to paper charts)?
 - Do clinicians and staff spend more/less time passing information back and forth with others in your practice, or waiting for someone else to finish with a chart before they can use it?
 - How do practice clinicians and staff use secure messaging to communicate with your patients?
 - What kind of topics do clinicians discuss with patients using secure messages?
 - Immediate health concerns?
 - General health issues such as lifestyle changes?
 - Patient self-monitoring/self-management?

- Medication questions?
 - Test results?
 - Specialist referrals?
 - Prescription refills?
 - Scheduling appointments?
 - Does your practice analyze the use of data from secure messaging? In other words: do you analyze:
 - How many patients have used secure messaging?
 - How much time you have spent using secure messaging,
 - What effect has it had on patient visits, calls, etc.
 - How does your practice use secure messaging to redesign your workflow and improve quality of care?
- **4. CONTINUED: Changes with regard to tools and technology, secure messaging**
- Do you think that “automation” of certain processes allows clinicians and staff to spend more time on patients?
- **Interactions:** Has the way you changed your use of tools and technology impacted the tasks that clinicians and staff do and the way the work is organized?

5. Changes with regard to the (physical) environment

- ☐ What changes did secure messaging implementation create for your practice’s work environment?
 - ☐ Do clinicians and staff have less paper to deal with?
 - ☐ Do clinicians and staff spend more time with computers?
 - ☐ For example, do clinicians and staff in the practice spend more time dealing with other people (colleagues and patients) using the computer, instead of talking to them face-to-face or via the phone?
 - ☐ Do they have to walk less, or more?
 - ☐ Are computer work stations located where they spend most time?
- **Interactions:** Did changes in the physical environment cause changes in the way work is organized
- **Interactions:** Did changes in the physical environment cause changes in the way tasks are performed?
- **Interactions:** Did changes in the physical environment cause changes in the way clinicians and staff interact with other people (colleagues and patients)?

6. Changes with regard to the person(s)

- Did clinicians and staff receive (extensive) training in the use of secure messages?
 - Are there changes in the way clinicians and staff in the practice perform their work? For example:
 - Who takes care of secure messaging in the practice?
 - Who customizes secure messaging?
 - Can clinicians and staff –as the end-users- make changes to secure messaging, to better fit their workflow?
- ➔ **Interactions:** Based on your experience, did these changes have an impact on the rest of the practice? For example, do you think that better trained personnel interact differently with their colleagues and with patients?

7. Changes with regard to the organization of the practice

- How has secure messaging affected the organizational structure of the practice? For example, new people hired, such as medical assistants?
- How has secure messaging affected the *processes* in the practice? Do people do other things and do people spend their time differently?

PROMPTS IF NEEDED:

- Number of patient visits? The length of patient visits?
 - Referrals?
 - Prescription changes and medication monitoring/management?
 - Do processes seem more or less efficient?
 - Preventive screening?
 - Patient education?
 - How you measure quality of care provided?
 - How many of your patients use secure messaging?
 - ☐ # per day
 - ☐ # per week
 - What percent of all your patients use secure messaging on a regular basis?
- ➔ **Interactions:** What are the consequences of these organizational changes for the practice?
- ➔ **Interactions:** Does it affect the tasks that people perform?

8. Secure messaging implementation and practice redesign

- ➔ Does secure messaging implementation provide you with opportunities to redesign your work and workflow? Can you please provide some examples?
- ➔ Does secure messaging make the processes more efficient?
- ➔ Does secure messaging allow you to spend more time on the direct care activities, the “core processes” of your practice, such as patient examination, patient communication. Can you provide some examples?

➔ 9. Secure messaging implementation and quality and safety of patient care

Secure messaging implementation and quality and safety of patient care

- How do you think that secure messaging affects quality of care?
- How does secure messaging affect continuity of care? For example, does secure messaging allow you to examine trends in patient data, or send out reminders?
- How do you think that secure messaging affects patient involvement?
- How do you think that secure messaging affects patient participation in decision making?
- What effect does secure messaging have on patient adherence? Patient self-management?
- How do you think that secure messaging affects care coordination?
- How do you think that secure messaging affects patient safety?
 - Do you think secure messaging reduces medical errors?
 - If yes, why? If no, why not?

9. Security and privacy of secure messaging

- What do you think about security, privacy, and confidentiality and secure messaging?
- How much of an issue is this for you?
- How much of an issue is it for patients, do you think?

10. Secure messaging and patient satisfaction

- Do you think that patients appreciate the practice’s use of secure messaging?
- Do some patients benefit more from secure messaging than others (e.g., patients with chronic care needs)?

11. Barriers to secure messaging

- What are the main barriers to successful implementation of secure messaging?
 - Start-up costs
 - Maintenance costs
 - Reimbursement for time spent using secure messaging
 - Privacy, security

- Privacy and security concerns of patients
- Computer skills of you and your colleagues
- Computer skills of patients
- Workflow adjustments
- Training
- Skepticism
- Increase in workload
- Lack of computer support in your workplace
- Lack of computer support (or hardware, internet access) for patients
- Legal risks
- Loss of face-to-face contact with patients
- Negative effect on patient-physician communication
- Other ...
- Which, of all those barriers, do you think is the most important one?

12. Facilitators of secure messaging

- Does secure messaging make your life easier? If yes, why, If no, why not?
- Does secure messaging improve the processes in the practice?
- Do you use data from your secure messaging to (further) improve/redesign your practice?
- Do you think secure messaging makes life easier for patients? If yes, why? If no, why not?
- Do you think that patients who use secure messaging and provide information, are better prepared when they come to the practice?

13. Final question

- Overall, how satisfied are you with secure messaging in your practice?

Appendix M. Observation Form

Observer (initials):

Study site #:

Day of observation:

Beginning time:

Ending time:

Please note the start time and end time of each instant where you observe patient-reported information being used by the clinician or office staff (PERSON, e.g., physician), what task is performed (TASK, e.g., reading an e-mail sent by a patient), the technology used (TECHNOLOGY, e.g., e-mail, and then the text is copied and pasted into the EHR), the environment (ENVIRONMENT, e.g., physician's office), and remarks about the organization (ORGANIZATION).

TIME	PERSON	TASKS	TECHNOLOGIES	ENVIRONMENT	ORGANIZATION

Appendix N. Interview Guide for Clinicians and Office Staff

If necessary [health IT] will be replaced by: patient portal, secure messaging, and/or e-forms, depending on the health IT implemented in a particular practice

Public reporting burden for this collection of information is estimated to average 60 minutes per response, the estimated time required to complete the interview. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to: AHRQ Reports Clearance Officer Attention: PRA, Paperwork Reduction Project (0935-0212) AHRQ, 540 Gaither Road, Room # 5036, Rockville, MD 20850.

Thank you for participating in the study today. The goal of the study is to understand the influence of things such as patient or provider characteristics; physical environment and layout; technical training and support; functionality and usability of health IT; worker roles; staff workload, stress, and job satisfaction; and communication flows—in capturing and using patient-reported information in ambulatory health IT systems and associated workflows.

Your participation includes an interview where we will ask you questions about the use of health IT to record patient-reported information and its impact on your workflow. In this interview we will ask you questions about health IT used at your practice that allows patients to provide information electronically and whether these technologies facilitate or hinder the way you organize your work. These types of health IT systems can include:

- Patient portals (sometimes referred to as [electronic] personal health records or PHRs; allow patients to view portions of their medical records [e.g., laboratory test results] and support other health-related tasks such as making appointments or requesting medication

refills. Some patient portal applications exist as stand-alone Web sites; other portal applications are integrated into an existing electronic health record [EHR] system);

- Secure messaging with patients (use of secure e-mail between patients and clinicians, typically using the secure messaging functionality in the EHR and/or patient portal); and
- e-forms (surveys that are administered using computerized media [e.g., tablets, laptops] to collect information from patients using pre-formatted forms before or during patient visits).

First we need to review an information sheet describing the study.

[Give subject copy of information sheet and review it with them].

Please read the sheet carefully. If you still would like to participate in the interview, please let me know. Do you have any questions before we move on?

[After respondent agrees to participate]

Thank you again for agreeing to participate in the study today. As I mentioned before, the goal of the study is to help us understand the influence of different factors—for clinicians and their office staff, and for patients—in capturing and using patient-reported information in ambulatory health IT systems and associated workflows. We would like to audio-record the interview to help us capture your responses. May we record the interview?

- *If subject has agreed to audio-recording:*
I have set up the tape recorder here in front of us. Please speak clearly during the interview so that the tape will record your voice accurately. I may ask you to repeat a response to make sure that it is recorded.
- *If subject has not agreed to audio recording and a note taker is not available:*
I will take notes during our conversation today. I may ask you to slow down or pause for a moment so that I can record what you say accurately.
- *If subject has not agreed to audio recording and a note taker is available:*
My colleague [NAME] will take notes during our conversation today. He/she may ask you to slow down or pause for a moment so that he/she can record what you say accurately.

During the interview, please use only your first name if you refer to yourself. This will help us keep your responses private. Your answers will not be individually reported to your care team members here at the clinic. If we do share information from the interview with clinic staff, we will only report it at the aggregate level, so that it is not obvious who said what.

The interview will take about 60 minutes to complete. If you need to take a break during the interview to use the restroom or get a drink, please let me know and we will pause the interview.

If any of my questions aren't clear or you don't understand a word that I use, please let me know and I will rephrase the question for you.

Please remember that you are not required to answer any specific question. You may also leave the interview at any time.

Do you have any questions before we start the interview?

1. Impact of patient-reported information on workflow

First, based on our observations, we want to ask you some questions about the impact of patient-reported information on your workflow. When we were observing you, we noticed the following instances where you used information that the patient reported using health information technology.

- Are those instances correct?
- Can you please elaborate a bit about those instances?
- For example, how does the use of that information fit into your workflow?

Can you think of other instances where you use information that the patient provided electronically, that we did not observe?

- If yes, what impact do they have on your workflow?

Next, we have some questions about how [health IT] and the information patients provide, using this [health IT] has an impact on different aspects of your work.

2. Changes with regard to the (physical) environment

- What changes did [health IT] implementation create for your work environment?

PROMPTS IF NEEDED:

- Less paper to deal with?
- Spending more time with computers? Less on the phone or faxing?
- Walking less, or more?
- Computer work stations located where needed?

➔ **Interactions:** Did changes in the physical environment cause changes in the way your work is organized?

➔ **Interactions:** Did changes in the physical environment cause changes in the way you perform your tasks?

➔ **Interactions:** Did changes in the physical environment cause changes in the way you interact with other people (colleagues and patients)?

3. Changes with regard to the person(s)

- Did you receive (extensive) training in the [health IT]?
- Are there changes in the way people in the practice perform their work?

PROMPTS IF NEEDED:

- Who takes care of [health IT] in the clinic
- Who customizes [health IT]
- Can users make changes to the [health IT]

4. Changes with regard to tasks you perform

- What activities do you do now (with [health IT]) that you did not do before (when you used a paper system)?

PROMPTS IF NEEDED:

- Spending more on certain tasks than before [health IT] implementation?
 - More or less time examining the patient? Talking with the patient?
 - Talking about different things when patients come for office visits (e.g., histories vs. current problems)?
 - Spending time helping patients use the [health IT] to report information (how to use the technology)?
- How do you access the information patients now report using [health IT] and what do you do with the information?
- Does [health IT] save you time?
- Does [health IT] help you prepare for a patient's visit?

➔ **Interactions:** What effects have these changes in tasks had on how you organize your work and your workflow?

5. Changes with regard to tools and technology

- How did [health IT] implementation change the way you use *tools and technology, such as the telephone, fax, and computers*?

PROMPTS IF NEEDED:

- Using certain tools less or more?
 - Phone with patients less or more? Email with patients less or more?
 - Helping patients use technology?
 - Spending more/less time looking for patient information?
 - Spending more/less time passing information back and forth with others, or waiting for someone else to finish with a chart?
 - What kind of topics do you discuss with patients, or gather information from them about, using [health IT]?
 - Immediate health concerns and follow-up
 - General health issues such as lifestyle changes
 - Patient self-monitoring/self-management
 - Medication questions
 - Test results
 - Do you examine/analyze the use of data from [health IT]?

PROMPTS IF NEEDED:

 - How many patients use it
 - How much time you spend using it
 - Effect on patient visits or phone calls
 - How do you use the [health IT] to redesign your workflow and improve quality of care?
 - Do you think that “automation” of certain processes allows you to spend more time on patients? How do you adapt when the system is down and patients cannot use [health IT]?
- ➔ **Interactions:** Has the way you changed your use of tools and technology impacted the tasks that you do and the way the work is organized?

6. Changes with regard to the organization of the practice

General questions:

- How has [health IT] affected the (organizational) structure of the clinic? For example, new people hired, such as medical assistants.
- How has [health IT] affected the *processes* in the clinic? Do you do other things and you spend your time differently?

Specific questions:

- How has [health IT] implementation affect the number of patient visits? The length of patient visits?
- How many of [your] patients report information to the clinic using [health IT]?
 - # per day
 - # per week
- What percent of all your patients use [health IT] on a regular basis?
- How does [health IT] affect the number of visits per day or the length of patient visits?
- How does [health IT] affect referrals?
- How does [health IT] affect information about test results? For example, do patients have questions about the test results they see in the patient portal?
- How does [health IT] affect prescription changes and medication monitoring/management?
- After [health IT] implementation, do processes seem more or less efficient?
- Do you use [health IT] for activities such as preventive screening and patient education?
- Does [health IT] impact how you measure quality of care provided?

7. Use of [health IT] in daily practice

- What does your work day look like? How do you use [health IT] during your work day?
- How does [health IT] affect workflow?

PROMPTS IF NEEDED:

- Frequency and timing for checking and responding to e-mail
- Triage of patient information
- Use of scripted templates or other mechanisms to manage patient information and communication
- Decisions about seeing patients in-person
- How does [health IT] affect your workload?
- How does [health IT] affect communication?
- Have you had any problems using [health IT] to communicate with patients? Example?

8. Usefulness and usability of [health IT]

- What do you think about the *usefulness* of [health it] and potential benefits of [health it]? Does health IT have benefits?

PROMPTS IF NEEDED:

- Useful for you individually
- Useful for patients
- Useful to redesign the practice for improved efficiency or effectiveness
- What do you think of *usability* of [health IT]?

PROMPTS IF NEEDED:

- Easy for yourself
- Easy for patients
- What part(s) of [health IT] do you like best?
- What part(s) of [health IT] could be improved?

9. [Health IT] implementation and practice redesign

- Does [health IT] implementation provide you with opportunities to redesign your work and workflow? Can you please provide some examples?
Does [health IT] allow you to spend more time on the direct care activities, the “core processes” of your practice, such as patient examination, patient communication? Can you provide some examples?

[Health IT] implementation and quality and safety of patient care

- How do you think that [health IT] affects quality of care?
- How does [health IT] affect continuity of care and care coordination?
- How do you think that [health IT] affects patient involvement and participation in decision making?
- What effect does [health IT] have on patient adherence? Patient self-management?
- How do you think that [health IT] affects patient safety or reducing medical errors?

10. Security and privacy

- What do you think about security, privacy, and confidentiality and [health IT]?
- How much of an issue is this for you? For your patients?

11. [Health IT] implementation and patient satisfaction

- Do you think that patients appreciate the clinic’s use of [health IT]?
- Do some patients benefit more from [health IT] than others (e.g., patients with chronic care needs)?

12. Barriers

- What are the main barriers against using [health IT] to do your work?

PROMPTS IF NEEDED:

- Start-up costs
- Maintenance costs
- Reimbursement for time spent using [health IT]
- Privacy, security
- Privacy and security concerns of patients
- Skills of you and your colleagues
- Computer skills of patients
- Workflow adjustments
- Training
- Skepticism
- Increase in workload
- Lack of computer support in your workplace
- Lack of computer support (or hardware, internet access) for patients

- Legal risks
- Loss of face-to-face contact with patients
- Negative effect on patient-physician communication

13. Other Facilitators

- Does [health IT] make your life easier?
- Do you use data from your [health IT] to (further) improve/redesign your work?
- Do you think [health IT] makes life easier for patients?
- Other

14. Final questions

- How does [health IT] affect you (personally)?
- Overall, how satisfied are you with [health IT]?

Appendix O. Patient Interview Guide

Thank you for participating in the study today. The goal of the study is to understand how patients share information about their health with the doctors and nurses who take care of them, using new technology.

Your participation includes an interview where we will ask you questions about computer systems you may use to provide health information to your doctor. Examples of such systems are entering information into a computer system before a visit, using a Web site offered by your doctor's office to share information with your doctor, or sending e-mails to your doctor. Before we begin the interview, we need to review an information sheet describing the study.

[Give subject copy of information sheet and review it with them].

Please read the sheet carefully. If you still would like to participate in the interview, please let me know. Do you have any questions before we move on?

[After respondent agrees to participate]

Thank you again for agreeing to participate in the study today. As I mentioned before, the goal of the study is to help us understand how patients share information about their health with the doctors and nurses who take care of them, using new technology. We would like to audio-record the interview to help us capture your responses. May we record the interview?

- *If subject has agreed to audio-recording:*
I have set up the tape recorder here in front of us. Please speak clearly during the interview so that the tape will record your voice accurately. I may ask you to repeat a response to make sure that it is recorded.
- *If subject has not agreed to audio recording and a note taker is not available:*
I will take notes during our conversation today. I may ask you to slow down or pause for a moment so that I can record what you say accurately.
- *If subject has not agreed to audio recording and a note taker is available:*
My colleague [NAME] will take notes during our conversation today. He/she may ask you to slow down or pause for a moment so that he/she can record what you say accurately.

Public reporting burden for this collection of information is estimated to average 30 minutes per response, the estimated time required to complete the interview. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to: AHRQ Reports Clearance Officer Attention: PRA, Paperwork Reduction Project (0935-0212) AHRQ, 540 Gaither Road, Room # 5036, Rockville, MD 20850.

During the interview, please use only your first name if you refer to yourself. This will help us keep your responses private. Your answers will not be individually reported to your care team members here at the clinic. If we do share information from the interview with clinic staff, we will only report it at the aggregate level, so that it is not obvious who said what.

The interview will take about 30 minutes to complete. If you need to take a break during the interview to use the restroom or get a drink, please let me know and we will pause the interview.

If any of my questions aren't clear or you don't understand a word that I use, please let me know and I will rephrase the question for you.

Please remember that you are not required to answer any specific question. You may also leave the interview at any time.

Once you have completed the interview, you will receive a gift of \$10 as a thank you for your participation.

Do you have any questions before we start the interview?

1. Health Information Technology

- Do you use technology to provide information to your health care providers, such as entering information into a computer system before a visit, using a Web site offered by your doctor's office to share information with your doctor, , and/or emailing your doctor or your doctor's office?
- If yes, did you receive help or support in using technology to provide information, for example from your doctor's office?

2. Online and tablet data collection before the visit

- Have you ever filled out a form on a computer before a visit to your doctor, for example a "health update" form or a description of your symptoms?
- If yes,
 - How often do you do this?
 - Can you tell us more about filling out a form on a computer?
 - For example, do you remember what kinds of questions were asked?
 - Walk me through how you go about filling out this form? What do you do first? What do you do next?
 - How was your experience doing that? Was it easy or difficult? Can you please explain what was easy or difficult?
 - Do you think it was useful or that it helped the doctor? Why do you think it is useful or not useful?
 - Do you prefer to enter information using a computer or would you rather provide the information on a paper form? Please explain.
 - Do you think the time it took you to fill out this form was too short, too long, or just right?

Secure e-mail with your primary care provider

- Did you ever contact your doctor using (secure) e-mail? Often (secure) e-mail is part of a patient portal, but sometimes you can also e-mail your doctor directly?
- If you did, why did you contact him/her?
 - To ask questions
 - To schedule appointment(s)
 - To refill medications
 - To ask for a referral
 - For other reasons...
 - How was your experience doing that? Was it easy or difficult? Can you please explain what was easy or difficult?
- Walk me through how you go about sending a (secure) e-mail to your doctor? What do you do first? What do you do next?
- Do you think it was useful or that it helped the doctor? Why do you think it is useful or not useful?
- Do you prefer to enter information using a computer or would you rather talk to the doctor in person? Please explain.
- When exchanging emails with your doctor or nurse, do you always answer their message immediately or do you answer their emails at a special time each day that is most convenient for you?
- Do you think the time it takes you to send a (secure) e-mail to your doctor is too short, too long, or just right? What about the time it takes your doctor (or doctor's office) to respond to your message?

3. Patient Portal

- Have you ever signed up for a patient portal, a Web site offered by your doctor's office called (Name of Portal Offered by practice [e.g., MyChart, PrimePatient, or SuccessEHS Patient Portal]) that contains your personal health information?
- Do you use the system? How often?
- If yes, why do you visit the patient portal?
 - To look at your medical record information:
 - Test results
 - Current health issues
 - Medications
 - Allergies
 - Immunizations
 - Health trends (vitals, such as blood pressure trends, body mass index trends)
 - Post-visit summaries
 - Billing information
 - To look at other useful information:
 - Health information library
 - Insurance information (benefits, claims, authorizations)
 - Wellness programs (fitness, Weight Watchers)
 - To make appointments

- To email your doctor or nurse
- Walk me through how you typically use the patient portal? What do you do first? What do you do next?
- How useful is a patient portal to you? Can you explain?
- How easy or difficult is it to use the patient portal. Can you please explain?
- Do you prefer to access your information through the patient portal, or would you rather see the information on paper? Please explain.
- Do you think the time it takes you to use the patient portal is too short, too long, or just right?
- Did you ever try and change the information on the patient portal? For example, adding a vaccination that was not in the list or an allergy? How difficult was it to make the change? How useful was it to make the change?
- Do you use a cell phone to get mobile access to test results, upcoming appointments, or other medical information?
- Do you use the patient portal to access accounts of other people (for example as a parent, guardian, or other caregiver)?
 - How useful is the patient portal to look at other accounts?

4. Computer experience

- How many years of computer experience do you have?
- How would you describe the level of your computer skills? Are you:
 - Novice user (You just started using computers)
 - Average user (You use word processors, spreadsheets, e-mail, surf the Web)
 - Advanced user (You can install software, setup configurations)
 - Expert user (You can setup operating systems; know some computer programming languages)

Thank you for taking the time to talk with us today.

Appendix P. Web-based Survey

Health Information Technology and Workflow

Clinician and Office Staff Survey

Public reporting burden for this collection of information is estimated to average 15 minutes per response, the estimated time required to complete the survey. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to: AHRQ Reports Clearance Officer Attention: PRA, Paperwork Reduction Project (0935-0212) AHRQ, 540 Gaither Road, Room # 5036, Rockville, MD 20850.

Instructions

We appreciate the time you are taking to complete this survey and hope that the information will help us better understand how new technology influences the work people do in physician practices.

This is a survey about health information technology such as:

Electronic Health Records (EHR or EMR, such as Allscripts, EPIC, EHS, Greenway);

Health Information Exchange (HIE: A system that transfers patient **health information electronically between two or more hospitals or other health care providers.**);

Patient Portal (sometimes referred to as [electronic] personal health records or PHRs; allows patients to view portions of their medical records [e.g., laboratory test results] and supports other health-related tasks such as making appointments or requesting medication refills. Some patient portal applications exist as stand-alone Web sites; other portal applications are integrated into an existing EHR system);

Secure Messaging with patients (use of secure e-mail between patients and clinicians, typically using the secure messaging functionality in the EHR and/or patient portal);

e-forms (surveys that are administered using computerized media [e.g., tablets, laptops] to collect information from patients using pre-formatted forms before or during patient visits).

When completing the survey, you can leave blank any questions that you do not want to answer. Your responses will be kept confidential to the extent permitted by law, including Section 944(c) of the Public Health Service Act. 42 U.S.C. 299c-3(c). That law requires that information collected for research conducted or supported by AHRQ that identifies individuals or establishments be used only for the purpose for which it was supplied. This survey has been designed to gather information about the work you do, the technology you use, and how the technology you use impacts how you do your work. Please try to answer all of the questions.

To answer the questions, check the appropriate box on the scale. For example:

	Never		It varies		Always		
Secure messaging has a negative impact on patient care.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input checked="" type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7

Some questions will require answers similar to the scale above, while other questions will require different responses. Please try to be as accurate as possible.

Section A. About your job

1. Please check your current job position:

(For respondents who have multiple jobs: please answer the question for the job position that you have spent most of your time in the last 6 months)

<input type="checkbox"/> ₁ Physician	<input type="checkbox"/> ₂ Specialist
<input type="checkbox"/> ₃ Physician Assistant	<input type="checkbox"/> ₄ Nurse
<input type="checkbox"/> ₅ Nurse Practitioner	<input type="checkbox"/> ₆ Medical Assistant
<input type="checkbox"/> ₇ Receptionist/Scheduler	<input type="checkbox"/> ₈ Lab or X-ray Technician
<input type="checkbox"/> ₉ Other (specify) _____	

2. How long have you been in your current position? _____ years
_____ months

3. How many hours do you work at your job in an **average** week? _____
hours per week

4. Do you use (please check all that apply):

<input type="checkbox"/> ₁ Electronic Health Records (EHR or EMR, such as Allscripts, EPIC, EHS, Greenway)
<input type="checkbox"/> ₃ Health Information Exchange (HIE, a technology that connects EHRs from different hospitals and practices)
<input type="checkbox"/> ₂ Patient portal (sometimes referred to as [electronic] personal health records or PHRs; allows patients to view portions of their medical records [e.g., laboratory test results] and supports other health-related tasks such as making appointments or requesting medication refills. Some patient portal applications exist as stand-alone Web sites; other portal applications are integrated into an existing EHR system)
<input type="checkbox"/> ₄ Secure messaging with patients (use of secure e-mail between patients and clinicians, typically using the secure messaging functionality in the EHR and/or patient portal)
<input type="checkbox"/> ₅ e-forms (surveys that are administered using computerized media [e.g., tablets, laptops] to collect information from patients using pre-formatted forms before or during patient visits)

5. For which of the following health IT applications did you receive training:

- ☐₁ Electronic Health Records (EHR)
- ☐₂ Health Information Exchange (HIE)
- ☐₃ Patient Portal
- ☐₂ Secure Messaging with patients
- ☐₂ e-forms

Section B. About organizational readiness for change

Please indicate your agreement or disagreement with the following statements, considering your practice:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. Among my colleagues, I am usually one of the first to find out about a new care process, diagnostic test, or treatment.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
2. After we make changes to improve quality, we evaluate their effectiveness.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
3. Our procedures and systems are good at preventing errors from occurring.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
4. We are innovative.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

C. About the patient portal

Patient Portals, which are sometimes referred to as [electronic] personal health records or PHRs, allow patients to view portions of their medical records (e.g., view laboratory test results) and support other health-related tasks such as making appointments or requesting medication refills. Some patient portal applications exist as stand-alone Web sites; other portal applications are integrated into an existing EHR system.

1. Does the practice you work in use patient portals (Web sites that allow patients to view portions of their medical records)?

☐₁ Yes

☐₂ No (*go to Section D*)

If you provide **direct care** (physicians, physician assistants, nurse practitioners, nurses, and medical assistants), please fill out the questions in Table **A** below.

If you **do not provide direct care** (receptionist, scheduler, technician), please fill out the question in Table **B**.

How much do you agree or disagree with the following statements about the patient portal?

TABLE A: Clinicians	Strongly disagree	Disagree	Neither	Agree	Strongly agree
1. The patient portal makes communication with patients more efficient.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
2. Overall, the patient portal saves me time.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
3. The patient portal has a negative impact on patient care.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
4. The patient portal has a negative effect on my workflow.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
5. The patient portal has a positive effect on patient-clinician communication.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
6. The information I receive from the patient portal makes an impact on my decision-making.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
7. The patient portal reduces my workload.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
8. The patient portal reduces patient care errors.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
9. The patient portal improves the quality of patient care.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
10. The information I get from the patient portal make my work easier.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
11. The patient portal has a positive impact on patient satisfaction	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
12. Overall, I am satisfied with the patient portal.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

How much do you agree or disagree with the following statements about the patient portal?

TABLE B: Non-clinicians	Strongly disagree	Disagree	Neither	Agree	Strongly agree	Not applicable
1. The patient portal makes communication with patients more efficient.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
2. Overall, the patient portal saves me time.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
3. The patient portal has a negative effect on my workflow.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
4. The patient portal reduces my workload.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
5. The patient portal improves the quality of patient care.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
6. The information I get from the patient portal makes my work easier.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
7. The patient portal has a positive impact on patient satisfaction.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
8. Overall, I am satisfied with the patient portal.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉

Section D. About secure messaging

Secure messaging refers to use of secure e-mail between patients and clinicians, typically using the secure messaging functionality in the EHR and patient portal.

1. Do you use secure messaging (secure e-mails between patients and clinicians)?

☐₁ Yes

☐₂ No (*go to Section E*)

If you provide **direct care** (physicians, physician assistants, nurse practitioners, nurses, and medical assistants) please fill out question 2 and the questions in Table A below.

If you **do not provide direct care** (receptionist, scheduler, technician), please fill out the question in Table B.

2. With what percentage of your patients do you communicate by secure messaging?

☐₁ 1-10%

☐₂ 11-25%

☐₃ 26-50%

☐₄ More than 50%

How much do you agree or disagree with the following statements about secure messaging?

TABLE A: Clinicians	Strongly disagree	Disagree	Neither	Agree	Strongly agree
1. Secure messaging makes communication with patients more efficient.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
2. Overall, secure messaging saves me time.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
3. Secure messaging has a negative impact on patient care.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
4. Secure messaging has a negative effect on my workflow.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
5. Secure messaging has a positive effect on patient-clinician communication.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
6. The information I receive from secure messaging makes an impact on my decisionmaking.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
7. Secure messaging reduces my workload.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
8. Secure messaging reduces patient care errors.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
9. Secure messaging improves the quality of patient care.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
10. The information I get from secure messaging makes my work easier.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
11. Secure messaging has a positive impact on patient satisfaction.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
12. Overall, I am satisfied with secure messaging.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

How much do you agree or disagree with the following statements about secure messaging?

TABLE B: Non-clinicians	Strongly disagree	Disagree	Neither	Agree	Strongly agree	Not Applicable
1. Secure messaging makes communication with patients more efficient.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
2. Overall, secure messaging saves me time.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
3. Secure messaging has a negative effect on my workflow.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
4. Secure messaging reduces my workload.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
5. Secure messaging improves the quality of patient care.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
6. The information I get from secure messaging makes my work easier.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
7. Secure messaging has a positive impact on patient satisfaction.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
8. Overall, I am satisfied with secure messaging.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉

Section E. About e-forms

Does the practice you work in use ***e-forms***? E-forms are surveys that are administered using computerized media (e.g., tablets, laptops) to collect information from patients using pre-formatted forms before or during patient visits.

☐₁ Yes

☐₂ No (*go to Section F*)

If you provide **direct care** (physicians, physician assistants, nurse practitioners, nurses, and medical assistants), please fill out the questions in Table A below.

If you **do not provide direct care** (receptionist, scheduler, technician), please fill out the question in Table B.

How much do you agree or disagree with the following statements about e-forms?

TABLE A: Clinicians	Strongly disagree	Disagree	Neither	Agree	Strongly agree
1. e-forms make communication with patients more efficient.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
2. Overall, e-forms save me time.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
3. e-forms have a negative impact on patient care.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
4. e-forms have a negative effect on my workflow.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
5. e-forms have a positive effect on patient-clinician communication.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
6. The information I retrieve from e-forms makes an impact on my decisionmaking.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
7. e-forms reduce my workload.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
8. e-forms reduce patient care errors.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
9. e-forms improve the quality of patient care.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
10. The information I get from e-forms makes my work easier.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
11. e-forms have a positive impact on patient satisfaction.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
12. Overall, I am satisfied with e-forms.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

TABLE B: Non-clinicians	Strongly disagree	Disagree	Neither	Agree	Strongly agree	Not Applicable
1. e-forms make communication with patients more efficient.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
2. Overall, e-forms save me time.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
3. e-forms have a negative effect on my workflow.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
4. e-forms reduce my workload.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
5. e-forms improve the quality of patient care.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
6. The information I get from e-forms make my work easier.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
7. e-forms have a positive impact on patient satisfaction.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉
8. Overall, I am satisfied with e-forms.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉

Section F. Barriers to using health IT in your work

How much of a barrier is each of the following to the use of health information technology (EHR, HIE, patient portal, secure messaging, e-forms) in your practice?

	Not a barrier	Minor barrier	Major barrier
1. Computer skills of you and/or colleagues/staff	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
2. Computer technical support	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
3. Lack of time to acquire knowledge about technology	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
4. Start-up financial costs	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
5. Ongoing financial costs	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
6. Training and productivity loss	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
7. Physician skepticism	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
8. Privacy or security concerns	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
9. Lack of uniform standards within industry (e.g., having to use multiple systems used by different providers and health systems/providers)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
10. Technical limitations of health information technology	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
11. Staff skepticism	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
12. Workflow changes	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃

Section G. About your perceptions of work

1. How satisfied are you with the care provided at your practice?	Totally dissatisfied	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7	Completely satisfied
2. How would you rate the quality of care provided at your practice?	Lowest	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7	Highest

The following questions deal with the workload that you experience in your job. Please put an 'X' on each of the following six scales at the point that matches your overall experience of workload.

	Lo	High
3. Mental demand. How much mental activity is required to perform your job (thinking, deciding, calculating, remembering, looking, searching, etc...)?		
4. Physical demand. How much physical activity is required to perform your job (e.g., pushing, pulling, turning, controlling, activating, etc.)?		
5. Temporal demand. How much time pressure do you feel due to the rate or pace at which the tasks or task elements occurred?		
6. Effort. How hard do you have to work (mentally and physically) to accomplish your level of performance?		
7. Performance. How satisfied are you with your performance at your job?		
8. Frustration level. How insecure, discouraged, irritated, stressed and annoyed versus secure, gratified, content, relaxed and complacent do you feel about your job?		
9. All in all, how satisfied would you say you are with your job?		

10. How likely is it that you will actively look for a new job in the next year?						
Not at all likely		Somewhat likely		Quite likely		Extremely likely
<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇

		A few times a year or less, almost never	Once a month or less, rarely	A few times a month, some- times	Once a week, rather often	A few times a week, nearly all the time	Every day
11. I feel emotionally drained from my work.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇
12. I feel used up at the end of the workday.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇
13. I feel fatigued when I get up in the morning and have to face another day on the job.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇
14. Working all day is really a strain for me.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇
15. I feel burned out from my work.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₆	<input type="checkbox"/> ₇

Section H. About you

- What is your gender? ☐₁ Male ☐₂ Female
- What is the highest level of education you have completed?
 - ☐₁ High school/GED
 - ☐₂ Some college
 - ☐₃ 2-year college degree (Associate)
 - ☐₄ 4-year college degree (Bachelor, BA, BS, BSN, etc.)
 - ☐₅ Master's degree (MA, MS)
 - ☐₆ Professional degree (MD, PharmD)
 - ☐₇ Doctoral degree (PhD, DNP, etc)
- How old are you? ☐₁ 34 or less ☐₂ 35-44 ☐₃ 45-54 ☐₄ 55+
- Are you of Hispanic or Latino origin? ☐₁ Yes ☐₂ No
- What is your racial background? (Check all that apply)
 - ☐₁ American Indian / Alaska Native
 - ☐₂ Asian
 - ☐₃ Native Hawaiian or Other Pacific Islander
 - ☐₄ Black / African American
 - ☐₅ White
 - ☐₆ Other (please specify):_____
- What description does best describe the level of your computer skills?
 - ☐₁ **Novice user** (You just started using computers)

- ☐ **Average user** (You use word processors, spreadsheets, e-mail, surf the Web, etc.)
☐ **Advanced user** (You can install software, setup configurations, etc.)
☐ **Expert user** (You can setup operating systems; know some computer programming languages, etc.)

7. How many years of computer experience do you have? _____ years

Please write any comments you may want to share with the research team.

Thank you very much for your participation in this study.

Appendix Q. Survey Design

Section	# of questions	Topic	References
A	5	Job characteristics <ul style="list-style-type: none"> • Job title • Tenure • # hours per week • Use of health IT • Training re health IT 	
B	4	Readiness for organizational change	<ul style="list-style-type: none"> • adapted from the Massachusetts e-Health Collaborative (MAeHC) survey⁷¹ • used previously in research on health IT supported case management implementation^{72, 73}
C	21	Secure messaging: User satisfaction and usability	<ul style="list-style-type: none"> • adapted from the Provider Order Entry User Satisfaction and User Survey⁷⁴
D	21	E-forms: User satisfaction and usability	<ul style="list-style-type: none"> • adapted from the Provider Order Entry User Satisfaction and User Survey⁷⁴
E	21	Patient portal: User satisfaction and usability	<ul style="list-style-type: none"> • adapted from the Provider Order Entry User Satisfaction and User Survey⁷⁴
F	12	Barriers to use of health IT applications	
G	15	Quality of working life <ul style="list-style-type: none"> • Perceived quality of care • Workload • Burnout • Job satisfaction • Turnover intention 	<ul style="list-style-type: none"> • perceived quality of care (adapted from Bertram et al.)⁷⁵ • workload^{76, 77} • burnout⁷⁸ • job satisfaction⁷⁹ • turnover intention⁸⁰
H	7	Personal characteristics <ul style="list-style-type: none"> • Gender • Age • Education • Race • Computer skills • Computer experience 	

Appendix R. Clinician and Office Staff Survey Invitation

You are being invited to fill out this survey because you work in a practice that uses health information technology (IT) to collect or use information reported by patients. Health IT used to collect patient-reported information can include e-forms (pre-formatted information collection mechanisms), secure messaging (email) between patients and providers, and patient portals (sometimes referred to as [electronic] personal health records or PHRs, patient portals allow patients to view portions of their medical records [e.g., view laboratory test results] and support other health-related tasks such as making appointments or requesting medication refills). Patients may use these systems to share information such as symptoms (e.g., pain, fatigue), results of self-testing (e.g., blood glucose levels, blood pressure), questions and concerns about weight, or over-the-counter medication use.

This research is sponsored by Agency for Healthcare Research and Quality (AHRQ), an agency within the U.S. Department of Health and Human Services, and is being led by researchers from Abt Associates, the University of Alabama-Birmingham, and the University of Wisconsin-Madison. The purpose of this research is to examine how patient-reported information and health information technology can be used well in small and medium-sized practices.

If you decide to participate, we would like you to fill out a survey describing your perceptions of your work using patient-reported information and health IT. The survey will take about 15 minutes to complete.

There is minimal risk associated with these activities. No identifying information about you will be collected and the surveys will be anonymous. All collected data will be stored on a secure password-protected computer server. We would like to assure you that all the information you share with us will be kept confidential to the extent permitted by law, including Section 944(c) of the Public Health Service Act. 42 U.S.C. 299c-3(c). That law requires that information collected for research conducted or supported by AHRQ that identifies individuals or establishments be used only for the purpose for which it was supplied.

If your practice is interested, the researchers will provide you with suggestions for improving the ways you collect and use patient-reported information. In addition, this research could give benefits to society by helping to improve how small and medium-sized practices collect and use patient-reported information.

Your practice will also be compensated for participating.

Participation in this study is voluntary. You may change your mind at any time and discontinue your participation without being penalized or losing any benefits you would have otherwise been entitled to.

Your participation in the survey implies that you have read the information above and that you give your consent to be a participant in the study.

If you have any questions about this research, please contact Andrea Hassol, the Project Director for this study, at (617) 349-2488 or Pascale Carayon, the Principal Investigator, at (608) 265-0503.

If you have any questions about your rights as a research subject or complaints about the research study that you could not resolve with the study team contact UWHC Patient Relations Representative at 608-263-8009 or the University of Wisconsin Medical Foundation Patient Relations Representative at 800-552-4255 or 608-821-4819.

Thank you for your assistance with this project.

Appendix S. Post Visit Follow-up Call Guide

Hi, my name is _____. As you know, I am calling from the University of Wisconsin-Madison. Thank you for agreeing to speak with us today.

On the phone is my colleague _____, also from the University of Wisconsin-Madison.

We scheduled up to one hour for this call. Does that still work with your schedule?

Thank you for the time to review the Workflow Process Map(s) of the work processes in your practice with us. The map(s) was created based on the observations and interviews that we conducted while we visited your practice.

We have several questions for you regarding the map(s) we sent you for review. Before we start, do you have any questions?

- Did you receive the Workflow Process Map(s) and did you examine it (them)? (Yes/No)
- What is your first impression of the map(s)?
- Are there processes that are represented incorrectly?
 - If yes, can you please explain?
- Are there processes that are missing?
 - If yes, can you please explain?
- Can you tell us how helpful such map(s) is to better organize the work in your practice?
- Do you have any additional comments regarding the map(s)?
- Do you have any questions for us?

Many thanks for your participation.

Public reporting burden for this collection of information is estimated to average 60 minutes per response, the estimated time required to complete the interview. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to: AHRQ Reports Clearance Officer Attention: PRA, Paperwork Reduction Project (0935-0212) AHRQ, 540 Gaither Road, Room # 5036, Rockville, MD 20850.

Appendix T. Sociotechnical Context: Organization

The sources of the information are indicated by [brackets]: [P] = Pre-visit questionnaire; [OI] = Observations and interviews; [Q]=Survey Questionnaire for clinicians and staff]

Sociotechnical Context: Organizational structure	Clinic 1	Clinic 2	Clinic 3	Clinic 4	Clinic 5	Clinic 6
Location	Midwest	Southeast	Midwest	Southeast	Midwest	Midwest
[P] Type of practice	Internal medicine	Family medicine	Family medicine	Primary and infectious disease care to HIV-infected patients	Internal medicine	Primary care to low-income and underinsured patients
[OI] Organizational structure	Patient-centered medical home (PCMH) working in care teams of providers, triage RNs and LPNs or MAs. Clinic implemented the PCMH model several years ago.	Solo provider supported by clinic manager, MA, receptionist, and billing specialist.	Patient-centered medical home (PCMH) working in care teams of providers, triage RNs and MAs.	Patient-centered medical home (PCMH) working in care teams of attending physicians, fellows or NPs, triage RNs and MAs.	Patient-centered medical home (PCMH) working in care teams of providers, triage RNs and MAs. Clinic has recently implemented the PCMH model.	Patient-centered medical home (PCMH) working in care teams of providers and MAs with a separate team of triage RNs.
[P] # of physicians	7 physicians (6 FTE)	1 physician	3 physicians	13 attendings and 10 fellows, each working one day per week (5 FTE)	7 physicians (6 FTE)	8 physicians (3 FTE)
[P] # of mid-level providers	4 PAs and 3 NPs	0	0	6 NPs	1 NP	1 PA and 1 NP, both primary care providers
[P] # nurses	6 triage RNs	0	2 RNs (one is interim clinic manager)	6 RNs	10 RNs, plus 1 RN who does anti-coagulation work	6 RNs, 4 staffing the clinic at one time
	2 LPN roomers			2 LPN roomers		6 LPN roomers
[P] # staff	7 MA roomers (1 CMA)	1 MA roomer	2 CMA roomers	4 CMA roomers	4 MA roomers	2 MA roomers
	7 schedulers for entire floor (29% of appointments are	1 front desk staff person (reception/scheduling)	3 receptionist/schedulers	5 receptionists/billing specialists	6 receptionist/schedulers who check in patients	3 receptionist/schedulers

Sociotechnical Context: Organizational structure	Clinic 1	Clinic 2	Clinic 3	Clinic 4	Clinic 5	Clinic 6
	internal medicine)				for the entire clinic	
	7 other staff: clinic manager, 4 unit clerks, 1 RN diabetes educator, office assistant	2 other staff: clinic manager, billing specialist		13 other staff: 8 social workers, 1 operations specialist, 2 nutritionists, 3 mental health professionals	2 schedulers who check out patients, schedule appointments and manage referrals; 1 dietician	1 RN clinic manager, 3 behavioral health staff, trainees (post-docs and students), part time – dietician, certified diabetes educator
[OI] Description of clinic manager	Professional with many years of clinic management experience. Used Lean to redesign clinic workflows and frequently examined data pulled from the EHR.	Wife of the physician, no experience with clinic management before husband opened the clinic 9 years earlier. Did not pull data from the EHR.	Interim clinic manager. RN who has worked in health system for many years and in clinic since time it opened. Did not pull data from EHR.	Clinic director is an NP who has worked in the clinic for many years. The new clinic manager worked as an assistant to the clinic director for several years. He knew how to get information out of the EHR and other databases, with help from onsite programming staff.	Two clinic managers – the director of business operations is a former Epic employee who is very familiar with the EHR. The director of clinical operations is an experienced RN who joined the clinic 18 months prior to data collection. She had made many significant changes to workflows during her tenure.	Clinic manager is an experienced RN who worked for the clinic for many years and has worked as clinic manager for 7 years. She fills in as a triage RN when needed. She reviews reports of data from the EHR but cannot pull data herself because the EHR is purchased through a larger health care organization.
[OI] Comments on other staff	A total of 30-40 schedulers work off-site at the “pod.”					
[QA2] Mean tenure Clinicians in years (NS)	10.1	14.5	10.6	6.2	6.7	5.5
[QA2] Mean tenure Staff in years (NS)	3.4	5.4	5.0	4.2	0.4	NA

Sociotechnical Context: Organizational structure	Clinic 1	Clinic 2	Clinic 3	Clinic 4	Clinic 5	Clinic 6
[QA2] Mean tenure All Personnel in years (NS)	6.7	7.2	8.2	5.6	5.3	5.5
[QA3] Mean working hours per week **	40.7	36.0	38.5	48.0	39.3	30.4
[P] # patients in panel	14,000 patients	~4,500 active, ~6,000 total	~2,400 in patient panel	~3,000 patients	~7,188 patients seen in the last year	~5,000 patients
Health insurance	Medicare (55%), Medicaid (5%) and a health insurance plan affiliated with the HCO (40%).	Medicare (10%), Medicaid (0%); most patients have Blue Cross or other private insurance.	Medicare (25%), Medicaid (5%) and most other patients are covered by a health insurance plan affiliated with the HCO.	30% of patients are low-income and uninsured and have their medical costs covered by grant funding, Medicaid (13%), Medicare (27%) and the remaining 30% have private health insurance.	Medicare (30%), and most other patients (70%) have private health insurance.	40% of patients are uninsured and pay reduced prices for health care on a sliding scale, Medicaid (50%), Medicare (5%) and private insurance (5%).
Type of patients	Clinic has a relatively large population of older patients.	Clinic has a relatively large population of young patients.	Clinic has a population of mixed age including pediatric and elderly patients.	Clinic has a relatively large amount of patients with low socioeconomic status.	Clinic has a relatively large population of older patients.	Clinic has a relatively large amount of patients with low socioeconomic status.
[P] # patients increase or decrease in last 5 years	Up 2,000	Increased	Increased	Increased by 800 patients	No change	Increased
[P] Years practice has existed	Over 20 years	8 years	1 year 8 months (organization in current form has existed since 1987)	27 years	Over 60 years	10 years (over 25 years for organization)
[P] Collaboration with other practices or hospitals	Part of large health care organization, including hospital	None	Part of large health care organization, including hospital	Part of university health system, including hospital	Affiliated with large HCO and physicians round on patients at the hospital of the HCO	Affiliated with large academic HCO: some physicians divide time between HCO and clinic

*, **, *** differences between clinics are statistically significant at $p < 0.05$, 0.01, and 0.001 respectively, NS: no statistically significant differences between clinics.

Appendix U. Sociotechnical Context: Technology

Sociotechnical Context: Health Information Technology	Clinic 1	Clinic 2	Clinic 3	Clinic 4	Clinic 5	Clinic 6
[P] Have EHR? Since when? Vendor?	Epic (12 years)	Bizmatix Prognosis (8 years)	Epic (1 year, 8 months; since founded)	Cerner Millennium (2.5 years), homegrown EMR prior	Epic (3 years)	Epic (13 years)
[P] Have e-prescribing? Since when? Vendor?	Epic e-Prescribing (3 years)	Prognosis (8 years)	Epic e-prescribing through Surescripts (since founded)	Cerner (2.5 years), homegrown system prior	Epic e-prescribing since June 2011	Epic e-prescribing since ~2008
[P] Have CPOE? Since when? Vendor?	Epic (12 years)	Prognosis (8 years)	Epic (since founded)	Cerner (2.5 years), homegrown system prior	Epic since June 2011	CPOE since 2001-2
[P] Have patient portal? Since when? Vendor? Can patients schedule appointments directly through a patient portal?	Epic MyChart (7 years); patients can schedule some kinds of appointments directly, if have seen the provider before and are established patient at clinic.	Prognosis patient portal (8 years), including direct scheduling (rarely used) and medication refill requests.	Epic MyChart (since founded). Patients can schedule appointments, but appointment is reviewed by one of clinic schedulers.	No, will be implemented in April 2014.	Epic MyChart since May 2012. Patients can request appointments by sending secure messages. Patients of two MDs use the portal to upload blood pressure and blood sugar measurements.	Epic MyChart since 2012 (version of Epic is not available in Spanish).
[P] Have secure messaging? Since when? Vendor? What types of messages?	Epic MyChart (7 years); messages for patient health questions, medication refill requests and scheduling appointments.	Prognosis patient portal (8 years).	Epic My Chart (since founded). Messages are first reviewed by RNs, then forwarded to MDs as needed.	No, will be implemented in April 2014.	Secure messaging through MyCharts since May 2012.	MyChart messages since 2012.

Sociotechnical Context: Health Information Technology	Clinic 1	Clinic 2	Clinic 3	Clinic 4	Clinic 5	Clinic 6
[P] Have e-forms? Since when? Vendor? What is purpose of e-forms? Replaced paper forms?	e-forms are for migraine patients to report health history and headache symptoms (IMH) (2 years). Replaced paper form.	No, were told that could not do it at time EMR was installed. During phone interview, clinic manager realized that e-forms are now on patient portal but are hardly used. Data cannot be submitted. Patients print out the forms and bring them to clinic.	No	Signs and symptoms e-form and PRO (patient reported outcomes) e-form since summer 2008. Signs and symptoms replaced a paper form.	E-forms for new patients were being implemented at the time of data collection.	Three months prior to data collection, patients are automatically sent pre-visit questionnaires through MyChart.
Can use patient portal to upload information?	No	No	A few patients have uploaded blood pressure or blood sugar measurements to the clinic.	NA	Yes, same health IT application as clinic 3.	No
[P] Have HIE? Since when? Vendor?	Care Everywhere – only for other organizations using Epic) for past 2 years.	No	Care Everywhere – only for other organizations using Epic) since founded.	No	Can access records of the HCO that they are affiliated with through EHR. Can access another HCO's data through "Carelink." Other data can be accessed through Care Everywhere.	Can access records of the HCO that they are affiliated with directly through EHR. Use Care Everywhere for other organizations using Epic.

Sociotechnical Context: Health Information Technology	Clinic 1	Clinic 2	Clinic 3	Clinic 4	Clinic 5	Clinic 6
[P] Have electronic communication with labs? Since when? Vendor?	Connected to labs through internet for past 12 years.	Yes, since founding of clinic. Have frequent issues with labs.	Connected to hospital labs through internet. Can see lab results for others through CareEverywhere.	Electronic connection to hospital reference lab. They are working on creating an electronic connection to LabCorp.	Use affiliated health care organization's Softlab to interface through Epic.	Connected to labs through 2003. Labs of larger hospital organization that they are affiliated with are reference labs.
	Not connected to external labs, only hospital labs.					
[QA5] Received training on EHR (% Yes)***	100.0%					
[QA5] Received training on HIE (% Yes)***	43.2%	NA	85.7%	3.0%	61.9%	53.3%
[QA5] Received training on Patient Portal (% Yes)***	81.0%	60.0%	71.4%	9.1%	52.4%	60.0%
[QA5] Received training on Secure Messaging (% Yes) ***	81.0%	20.0%	71.0%	9.1%	42.9%	40.0%
[QA5] Received training on e-Forms (% Yes) ***	14.0%	20.0%	NA	57.6%	NA	NA
[OI] % of patients <i>reporting information using patient portal</i>			3-4 patients uploaded blood pressures and/or blood sugars into MyChart, none are actively using it.		Patients of two physicians in the clinic upload blood pressures and/or blood sugars into MyChart.	
[OI] % of patients <i>reporting information using secure messaging</i>		Approximately 15%	60% are enrolled, 51% activated their accounts.		10% of patients (~350 people) sent a message during April 2014.	12% of patients are enrolled; 8-9% of patients send messages.

Sociotechnical Context: Health Information Technology	Clinic 1	Clinic 2	Clinic 3	Clinic 4	Clinic 5	Clinic 6
[QD2] <i>communicate with % of patient through secure messaging*</i>	~25% 1-10%: 21%; 11-25%: 38%; 26-50%: 38%; >50%: 3%	~18% 11-25%: 100%	~23% 63 secure messages sent in one week 1-10%: 40%; 11-25%: 40%; 26-50%: 0%; >50%: 20%		1-10%: 62%; 11-25%: 31%; 26-50%: 8%; >50%: 0%	Average of 25-20 MyChart messages per week, 4-5 per day. 1-10%: 67%; 11-25%: 33%; 26-50%: 0%; >50%: 0%
[OI] % of patients <i>reporting information using e-forms</i>	Most headache patients (80-90%) use the software.	NA	NA	All patients complete the signs and symptoms e-form, 2,642 patients complete the PRO and approximately 300 have withdrawn from PRO.	NA	NA
[P] Health IT support	Practice has health IT support, but not in the clinic.	Practice called Prognosis directly for tech support. Vendor is very responsive.	HCOs EpicCare team (off site) provides a help desk, training, and support.	Programmers, informatics support staff and other health IT support staff work in the clinic and provide hands-on support in use of technology.	Epic super-users help staff within the clinic.	Epic super-users help staff within the clinic.
	A department within the larger health care organization is responsible for IT implementations and helps with health IT implementation.				Larger HCO IT department provides support, including a help desk.	Larger HCO provides health IT support, including a help desk

Sociotechnical Context: Health Information Technology	Clinic 1	Clinic 2	Clinic 3	Clinic 4	Clinic 5	Clinic 6
[OI] Documentation by the practice related to patient-reported health information technology processes	Inbox reduction projects were completed by two clinic MDs. One MD provided us workflows.	None	None.	Signs and symptoms and PRO data are reviewed and used for research purposes and review of clinic processes.	Review some Epic information to redesign processes, but not patient-reported information.	Clinic staff do not review data from their patient portal to analyze their processes. It is challenging to receive data from the larger HCO. They must request data and wait for it to be delivered. They are not always sure what data are available, and the data they receive is not always what they really wanted.
[P, OI] Future plans for implementing health IT	Processes are being redesigned using Lean. No health IT implementations are planned.	None that they mentioned	Larger HCO is in a big push to encourage patients to use MyChart. They are planning to roll out e-visits late in 2014.	Patient portal will be implemented in April 2014.	E-forms for new patients were being implemented at the time of data collection.	None

*, **, *** differences between clinics are statistically significant at $p < 0.05$, 0.01, and 0.001 respectively, NS: no statistically significant differences between clinics.

Appendix V. Signs & Symptoms E-form

Survey - Mozilla Firefox

http://1917webdev/SignsAndSymptoms/SurveyPage.aspx

Most Visited Getting Started Latest Headlines Suggested Sites Web Slice Gallery

4 Days Only! 25% off ALL Tabletop... Emery 14-Photo Wall Frame - Fram... Home | Daily deals for moms, bable... Survey

SIGNS AND SYMPTOMS

	Do not have this symptom	Have, but doesn't bother me	Bothers a little	Bothers some	Bothers a lot
Fatigue	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fever, Chills, Sweats	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dizzy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Numbness / Pain feet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Memory	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nausea / Vomiting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diarrhea	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nervous / anxious	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Poor sleep	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Done

1917 Clinic - Signs and Symptom...

Name: Dummy Patient (PADU0000)

Review of Symptoms (last 4 weeks)

Symptom	Answer
Fatigue	Have, but doesn't bother me
Fever, Chills, Sweats	Bothers some
Dizzy	Bothers a lot
Numbness / Pain feet	Have, but doesn't bother me
Memory	Bothers a little
Nausea / Vomiting	Bothers some
Diarrhea	Do not have this symptom
Sad	Bothers some
Nervous / anxious	Bothers a lot
Poor sleep	Bothers a lot
Rash	Bothers a lot
Cough / SOB	Bothers some
Headache	Bothers some
Poor appetite	Bothers a little
Bloating, abdominal pain	Bothers a lot
Muscle aches / joint pain	Have, but doesn't bother me
Sex problem	Have, but doesn't bother me
Fat deposit / Weight gain	Bothers some
Weight loss / wasting	Have, but doesn't bother me
Hair loss / changes	Bothers some

Scale from low to high

1: Do not have this symptom

2: Have, but doesn't bother me

3: Bothers a little

4: **Bothers some**

5: **Bothers a lot**

No Response: Patient didn't answer

Do you smoke tobacco? ☐ Yes ☐ No

If Yes, How many packs do you smoke each day:

Temp:

Pulse: Resp:

BP: /

Wt: lbs.

Done

Appendix W. E-forms: PRO

CNICS

Please indicate how often over the **LAST 2 WEEKS** you have been bothered by any of the following problems.

	Not at all	Several days	More than half the days	Nearly every day
Little interest or pleasure in doing things	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling down, depressed or hopeless	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trouble falling or staying asleep, or sleeping too much	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling tired or having little energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Poor appetite or overeating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[< Previous](#)
[Next >](#)
[Next Page](#)

[Change Language](#)

at has full read and write permission to all patient
If you are a patient please refuse to take this survey

ent Answer	Progress	Patient Page	Screening Report
4-10 15:21:56	<div></div>	Go	Go
4-10 15:01:59	<div></div>	Go	Go
4-10 14:43:11	<div></div>	Go	Go
4-10 14:30:16	<div></div>	Go	Go
4-10 14:21:27	<div></div>	Go	Go
4-10 14:28:39	<div></div>	Go	Go
4-10 14:00:51	<div></div>	Go	Go
4-10 14:48:10	<div></div>	Go	Go
4-10 12:55:10	<div></div>	Go	Go
4-10 11:59:26	<div></div>	Go	Go
4-10 12:01:52	<div></div>	Go	Go
4-10 11:47:00	<div></div>	Go	Go
4-10 10:18:30	<div></div>	Go	Go
4-10 10:07:42	<div></div>	Go	Go
4-10 09:20:13	<div></div>	Go	Go

Appendix X. PRO Summary Report

Patient-Based Measures Provider Feedback

Name: [REDACTED]

Date Completed: 2013-05-01 14:06

Instrument	Interpretation
PHQ-9 Overall depression score last 2 weeks 15	Moderate depression (10-19)
PHQ-9 Suicidal ideation score last 2 weeks 2	Several days
Substance use within last 3 months None	
Tobacco use No	
Alcohol Score (AUDIT-C) 1	Not at-risk alcohol consumption (<5)
Antiretroviral adherence	
Adherence in the past 4 weeks	Excellent
Last missed	I never skip medications
High risk behavior-last 6 months	
Anal sex condom use: All the time	
Vaginal sex condom use: Had vaginal sex with 0 people in the last 6 months	
Sharing needles or injection equipment: never used non-medical drugs by injection	

[Start new survey](#)